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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

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Belgian Foundry Costing.

The Belgian Foundrymen's Association recently appointed a committee to report upon the procedure to be followed to ascertain the cost price of grey-iron castings. The conclusions arrived at were published in the October "Bulletin" of the Association, Mons. G. Masson, foundry manager to Messrs. Ketin, of Sclessin, being the secretary. Their work was divided into four main sections:—(*a*) Ascertaining the price of the liquid iron ready for the mould. (*b*) Wages. (*c*) Other costs. (*d*) General remarks. Section (*c*) admitted of four divisions:—(1) Manufacturing costs; (2) stores; (3) overhead charges; and (4) selling prices

The first section is of great interest for British foundrymen as cupola costs can mean the obtaining or losing of an order or the difference between a profit and a loss. For the ascertaining of this figure the foundry is required to send in after each blow a charge sheet setting out the quantity and quality of all materials used, the rough weight of the castings made and to what order number, and the weight of the over-metal. On the reverse side the exact weights of the cleaned castings are given. After reducing the pig-iron charges to money values, transport, unloading and pig- and scrap-breaking charges are added, after which all the other materials used during the month not only those necessary for melting but also costs of upkeep and repairs of the cupolas, blowers, hoists and ladles. *The sum thus expended is divided between the various mixtures in the ratio of the production.* Wages and power are apportioned in the same ratio. The former is made to include cupola staff, labourers (masons) detailed to prepare the ladle, and a portion of the mechanics' time when engaged on this plant. There is further to be added that proportion of the laboratory costs appertaining to the analysis of raw materials, and a portion of the yard costs, divisible between melting, moulding and dispatching, to be based on either tonnage or numbers of wagons. Finally, there is the depreciation, which the Committee recommend to be 5 per cent. for cupolas, blowers and hoists, and 10 per cent. for large ladles and 100 per cent. for shanks and accessory material. The annual amount to write off will not be by months or twelfths, but on production. If a plant should produce 1,500 tons per annum, has cost x pounds, and allowing the 10 per cent. depreciation, then the amortisation per ton will be x divided by 10, multiplied by 1,500. This means that if standard production has not been attained then the depreciation will be extended.

After adding all the above factors, runners, risers and over-metal are substracted at scrap value. If this figure, when converted into price per 100 lbs. for any one mixture, is called y, and if it takes 100 lbs. of metal to make 85 lbs. of castings, the cost price of the iron for that grade of casting is y multiplied by 100 divided by 85. The difference between this figure and the cost of the iron mixture per unit weight represents the "transformation cost," which can be utilised as a rough basis for quoting so far as the iron is concerned. Under Section (2)—wages—the committee make nine divisions—(1) pattern-making; (2), loam moulding; (3), core-making; (4), hand moulding (*a*) dry, (*b*) green; (5) machine moulding (*a*) dry, (*b*) green; (6) unloading raw materials; (7) cupolas; (8) fettling; (9) dispatching.

The system outlined is a card system, whereon the workman puts the number of hours expended on each job. Whilst the balance of the report has not such a direct concern for the foundryman and presents little novelty, it is interesting to note that the hundred and one small stores, such as blackings, chains, sprigs and the like, which cannot be charged to any one job, are made a general overhead charge.

The system of basing metal costs on each mixture used in the foundry appears to be excellent for machine-moulded castings, but it obviously assumes less importance when loam-moulding very heavy castings, as in such cases the major portion of the cost falls on the moulding side, and the metal costs are comparatively insignificant. The Belgian Association is to be commended on its work, and it is well worth the while of other countries to follow, especially if it helped to suppress the system of a standard weight-price for every order received for one firm.

XUM

The British Cast Iron Research Association.

Progress of Research Work in Hand.

In the monthly circular for November the new Director of Research (Dr. P. Longmuir) states that since commencing his work he has been taking stock of the position of the principal researches in hand and formulating a scheme for their progressing as rapidly as possible.

Cast Iron Moulds for Making Glass Bottles.—The Director has arranged a scheme of research upon moulds for these, special castings will be made at once for the purpose of practical works tests. There is a very wide field here to give the members a new trade opening. A large number of these moulds are imported from abroad. These will, it is hoped, be now made in this country.

Magnetic Properties of Cast Iron.—Enquiries having been sent in to the Association upon this important matter, the Director is taking steps to commence an investigation so that the Association can be in a position to advise members upon same.

High Silicon Cast Iron to Withstand Mineral Acids.—It has been pointed out to the Association that a research into this material is of very great importance to the cast-iron industry and to other allied trades. Some work has already been done by outside agencies without very great results being obtained. The Association will, therefore, take the matter up at once.

Standardisation of Testing Methods for Cast Iron.—The Special Committee appointed to investigate the standardisation of test bars are collecting a large amount of practical data and have received valuable help from the American Testing Society. A questionnaire has been issued and the replies are being tabulated; the conclusions of the Committee will be of great assistance in drawing up an international standard for testing.

Suggestions from Members.—The Director will welcome suggestions from members as to possible new lines of research that will benefit the industry generally, and will be glad to interview members upon any suggestions that are made.

Problems Received.

During the past month the problems sent in by members for investigation have been of a varied nature, and again prove the value of the Association in being able to remove difficulties which must tend to retard production. Reports upon the following problems have been sent to members, copies of which will be published in the Bulletin:—

Mixture for chilled cast-iron brake blocks; Chromium in cast-iron casting; Mixture for cast-iron desilverising pots; Cupola fans and blowers; Cupola practice for heavy castings; Mixture for heavy castings; Cupola proportions for special work; Testing Diesel-engine cylinders; Chilling iron rolls; Mixture for cast-iron balls for grinding mills; Cupola melting practice; Defects in valve castings; Mixture for special malleable castings; Cupola design for special melting.

The Bureau and Library.

The "Intelligence Service" of the Bureau has been called upon during the past month to supply data and copies of papers upon a variety of foundry subjects. Associate members particularly are using the Bureau to assist them in their work. The Bureau has not yet failed to supply any data or information asked for. Whenever it is used its great value is at once brought home to the member.

Membership.

During the past month several new members were elected, and an exceptional large number of applications have been received from foundries for details of membership, showing that as trade revives they are recognising that it is to their interest to join the Association, and so enable it to carry out the larger research works for the improvement of the methods of manufacture which the industry has so long waited for. The Council desire to double the membership during the present financial year, and every foundry should help to attain this end.

Annual Report.

The Council have issued their Report of the first year's work, a copy of which will be forwarded to anyone interested upon application.

Members' Crest.

It is very important that purchasers of iron castings should know who are members of the Association, as such membership gives them a guarantee that the Association's advice can be obtained for the better production of their work. It has therefore been decided that members can use the Association's crest upon all their stationery. The various Government Purchase and Contract Departments have been advised as to the significance of the crest.

An Electric Duplexing Process.

An interesting new steel-making process has been put into successful operation at the works of Messrs. Edgar Allen & Company, Limited, Sheffield, which promises a great revolution in electric steel melting in the near future.

The Stobie Steel Company of Dunston-on-Tyne, has installed in those works one 10-ton and one 3½-ton electric steel-melting furnaces which are being worked together as a single unit under the Stobie patent duplex electric process. By this means, scrap steel is electrically melted and refined by oxidation in a continuous manner in the large primary furnace, and a third or more of the molten bath is transferred down a shoot at short intervals to the small secondary furnace for finishing.

Electrical and Metallurgical Advantages Shown.

Electrically, the load factor is greatly increased by the continuous working, and the power factor is much improved by the maintenance of, mainly, molten baths. Fluctuations of current are, also, less marked and of shorter duration.

Metallurgically, the main advantage is the frequent supplies of small quantities of steel, of varying compositions if required, at the low cost of operating plant of large output. For ingot or foundry work, this advance in practice is of considerable interest. Such a process should go far to the commercialisation of the centrifugal casting of steel, as it should provide a more continuous source of liquid steel.

Additional advantages of the new process over an installation of several furnaces working independently include the less space occupied by the plant; the reduced crane service required; the much reduced repairs to furnace linings for a given output of steel, and the freer choice in scrap for melting.

Catalogues Received.

MESSRS. LAWSON, WALTON & COMPANY, LIMITED, 2, St. Nicholas Buildings, Newcastle-on-Tyne. Foundry supply stock list for November.

MESSRS. CONSETT IRON COMPANY, LIMITED, Consett, Durham. Booklet containing representative photographs of the various grades of pig-iron they manufacture.

THE SKEFCO BALL-BEARING COMPANY, LIMITED, Luton. A catalogue giving much useful information about ball-bearings. A section is devoted to their lubrication.

MESSRS. UTILITY PRODUCTS, LIMITED, 212, Hunter Street, Glasgow. A catalogue for Ford car users, outlining the utility of Hudco-Ford pedal slip transmission covers, which reduces the time of removing brake band linings to twenty minutes.

A General Council meeting of the Institution of British Foundrymen is to be held at York on December 9.

AMERICAN FOUNDRY PRACTICE.—"My Visit to American Foundries and Impressions" is the title of a lecture which Mr. Oliver Stubbs, M.I.Mech.E., past-president of the Institution of British Foundrymen, will deliver before the Lancashire Branch on December 2.

Jobbing Foundry Moulding Boxes, with Some Notes on Runners and Risers.*

By C. Bickerton, A.M.I.Brit.F.

This Paper deals only with the heavier type of moulding boxes, which are usually lifted by mechanical power. A moulding box, as seen on its side, apparently presents little difficulty of manufacture, but deeper consideration shows that its usefulness and durability depend upon its construction. It is quite common to find boxes over 5-ft. sq. broken at the corners, due to contraction. These are usually clamped or burned, or provided with a wrought-iron patch.

The largest box made by the Author weighed 8 tons. It was 16 ft. long by 11 ft. wide by 12 in. deep. Of the timber used the outside frame was 2 in. wide, the inside bars being 1¼ in. These figures refer to the rough state, which necessitated planing in order to give it the necessary taper. Though made about 10 years ago, it is still in good condition. During this period it has been used for heavy work with deep lifts, and at other times for moulds involving numerous heavy cores, the box having to be turned over with these in position.

The range of boxes made by the author varied from 16 ft. × 10 ft. 6 in. × 12 in. deep to 4 ft. square by 6 in. deep. The method utilised for avoiding contraction breaks was by putting lugs on the corners, and casting-in splitting plates provided with bolt holes. After casting, the inside bars are covered over with sand, leaving the outside portion uncovered, as this latter is thicker. The various lugs that are cast-on are for splitting, staking and handles. It is preferable to leave the box in the sand until cool. When the casting is fettled, bolts are put in the corners, and if the splitting plates have become loose, packing is used to replace them, the whole job being screwed up, but not too tightly. All boxes greater than 4 ft. 6 in. sq. should be split at the corners, and should have holes cast in the ends for bolting on extension pieces. Another precaution which is advisable when making balance weights or similar castings having a thick body of metal, is to keep the bars at least 2 in. from the casting, and if convenient, to take the top part off as soon as it is thought the casting has set, otherwise the box may be found to be broken the following morning.

Of the timber used for this type of box, the outside frame should be one and a-half to twice the thickness of the inside bars. Boxes greater than 2 ft. 6 in. sq. are often found to be useful when a central square space is left to admit the long bosses associated with wheels, pulleys, and the like, for it saves a deep lift, as it is possible to bolt a small box-part on the top. Holes should be cast in the two sides of this space, and loose bars cast to bolt in when used for a flat top. Two important factors which need emphasis are the necessity for employing good metal, casting at high temperature, and the use of strong lifting handles. Obviously weak handles are dangerous, and if broken off, the box becomes much more difficult to handle. On one occasion when turning over a box one of the handles gave way on reaching the vertical position, necessitating the use of props, whilst two bars were cut out in order to thread a chain through it to lower it down. This box was 13 ft. × 8 ft. × 10 in.

Weighing Machine Girder Box.

An interesting box which was made by the author was one for making a weighing machine girder about 21 ft. long. It was a Government order, and a joint mark in the middle of the casting was objected to. This necessitated the use of one box for the whole job. A box 22 ft. long and 3 ft. 8 in. wide takes up much storage room, and is not likely to be used often. It was therefore made in two lengths, and was bolted together in the middle. The order being completed, the box was dismantled, and when placed on end took up very little shop room. Square holes were cast in the ends of each half for swivels, so that they could be turned over on trestles.

On assuming a fresh position, the author found half-completed a box for a dry-sand job to be cast on end. The pattern was cylindrical and of different diameters. It incorporated a large flange about 1 ft. from one end. The outside frame was already cast and bolted together, with holes for loose bars to be bolted in. There were 17 bars for each half to suit the different diameters of pattern. The dimensions of each half-frame were 7 ft. 7 in. × 2 ft. 3 in. × 1 ft. 4 in. There were four bolt holes for each bar. Instead of making all these bars an ordinary box pattern was made, 6 in. deep, to drop inside the frame with the core prints in position to suit the holes cast in the frame. Two of these were cast without handles and bolted into the frame, using for this purpose 12 bolts for each half, instead of 17 bars with four bolts in each bar. This box can now be used for patterns of various diameters without alteration.

Troubles from Pins.

The pins for this box presented difficulty. Holes were cast in the lugs, in one part being about ⅞ in. sq. and in the other 1¼ in. × ⅞ in. This made it almost impossible to make a good joint. However, the joint in the box was marked before parting, and on closing the marks met correctly, and it was bolted and cottered up. When the mould was stripped it was found that the casting was twisted, probably due to putting the mould on end for casting, which might have allowed the pins to move. To prevent a recurrence of this the slot holes were filled with white metal whilst the pins were in, after which no more trouble was experienced.

A 20-off pattern, weighing about 18 cwts., required a box 4 ft. 6 in. × 4 ft. × 2 ft. 9 in. deep, for turning over. A 4-ft. sq. frame was found of the right depth, and two extension pieces to give the additional length were inserted. This served the purpose, and as the top presented a flat surface, odd top parts were used and staked at the corners.

Box Handles.

For heavy boxes the safest lifting handles are those cast in the side of the box and shaped like a fender. Such handles in this position serve many useful purposes. For example, if there is a heavier lift at one end of the box a chain hook can be placed on the outer end of the handle, thus shortening the chain without twisting it. Another useful purpose served by these handles is the ease with which they can be packed if there is only a narrow margin of bearing between the mould and the box edge. If a plate is bedded underneath the handles before taking off the box when finished with, and replacing it again, packing can be inserted between the plate and the handles before placing in position the holding-down weights, or a plank can be placed along each side of the box spanning the two handles and then by ramming between the box and the plank run-outs can often be prevented. Obviously these planks should be removed as soon as possible after casting to prevent burning.

Ease of turning over the box is another advantage. Handles on top, in the author's opinion, are not so useful, as they serve no other purpose but lifting. They are useless for turning over boxes, and quite often in the way of packing chaplets or weighting down. Flanges cast on the sides of the boxes for lifting purposes, using dog hooks, are suitable for narrow boxes, which are turned over on trestles near the job, but are not suitable for transporting about the foundry, as they easily slip.

Weighting Boxes.

When using two or more top parts for the one casting a bad joint on the casting is sometimes produced through one box having sunk lower than the other. To avoid this it is good practice to

* A Paper read before the Burnley Section of the Lancashire Branch of the Institution of British Foundrymen.

bed a weight on the joint, the weight being sufficiently long to catch the end of each box. If three boxes are used the same principle applies to the other end, and when putting bearers on the top for holding down weights it is essential to see that they reach well on each box away from the joint, and to pack the ends under the bearers after all the weights are in position. For a deep casting having only a narrow margin of bearing between the box and the mould, and necessitating a heavy load of holding down weights, it is advisable to put two other weights under the box edge on each side, and in cases of this kind it is advisable to bed a plate for each lot of weights below the bottom face of the casting, and to build up the joint to this.

Lifting Grids.

Patterns necessitating a deep lift under the top part are often too deep for the gaggers available. In such cases lifting grids are necessary. These are made similarly to core grids, provided with prods and wrought-iron staples. If the lift is a side joint, such as a large diameter pipe, which necessitates using the flat top, after having made the down joint and top joint, a thin layer of facing sand should be put on the bottom joint and grids bedded on. The job is then rammed up to the top joint, inserting straight irons where necessary in order to strengthen the side of the joint.

When ramming up the grids some preparation should be made for packing the grids to the box bars before starting to ram up. Hook bolts should be put in the staples in the grids, and the grids packed under the box bars. When rammed up, fishplates are put on the bolts and screwed up tightly. If the deep lift is on the pattern and there is a good surface of metal, it is preferable to pack the grids away from the pattern, and to allow a space of 1½ in. to 2 in. between, so that one can insert gaggers through the grids on to the face of the pattern. The reason for this is that there is only a thin layer of facing sand between the grid and the casting, and it invariably boils off or scabs unless well dried, but drying does not necessarily ensure good results, on account of the grids expanding on heating and contracting on cooling, which leaves cracks on the face of the mould resulting in the sand shelling off from the grids.

Deep Lifts and Grids.

For such deep lifts incorporating grids and where doubt exists as to the possibility of turning over the mould, it is advisable to put clamps or fish plates on the side of the box and pack it with boards or stays from these to the joint on the opposite side of the box to the chains. Such an arrangement also serves for deep cores, such as are necessary for headstocks, etc.

In cases where a pattern incorporating two different heights such as gap-lathe beds, slotting machines, etc., where it is more convenient to use two boxes, one for the lower and one for the higher level, a grid or plate with prods will be necessary to fasten on the end of the lower box, in order to carry the sand to the height of the top joint. Such plates are usually bolted to the end of the box. If there are no holes cast in the box they have to be drilled in, to suit the holes cast in the plate. A better method when making the plate is to cast two lugs on each side, these being provided with a wrought-iron staple, the distance between the staples should be equal to the depth of the end of the box to which they are to be fastened. The height of the staple from the face of the plate to the inside of the staple should be equal to the thickness of the box end plus 1½ to 2 in.

The plate is fastened on the end of the box, and an inch wrought-iron bar is dropped through each pair of staples, and wedges are placed between the wrought-iron bar and the box, the whole being wedged up tightly. If the space between the staples is wider than the box edge, it must be so packed that it cannot move. It is additionally necessary to ascertain that there is sufficient depth of joint to allow the lugs to miss the pattern.

Gating of Castings.

The method of gating and running castings differs in most districts, but the basis of the author's practice is to run heavy castings as quickly as possible, especially where there is a large surface of metal. It should be stated that the author's experience has been mostly with heavy and light tool and engine work, and his remarks will be confined to this class of casting.

Machine Tool Castings.

On receipt of the pattern, the surfaces to be machined must first be ascertained, and whether such surfaces are to be used as slides or bearings for brackets or standards. With this knowledge an endeavour is made to keep the runners as far from the machined parts as possible, as dross is usually to be found in close proximity to the gates. Base plates are usually run from the bottom at one end, the size and number of runners being decided by the weight of the casting, and the distance the metal has to travel. The down-gates from the joint to those leading into the mould should not pass through the top, but should be supplied with two others rammed up in the top a little distance away. The runners leading into the casting should be of a little larger area than the down gates, in order to allow the metal to flow into the mould more easily. In the case of small lathe beds having facings cast on for the standards it is advisable to ram a lump in the top at each side, and to cut sprays from the top of the facing into these, and then make the metal rise through the top. This often prevents blowholes and takes away most of the dross. They are, however, only necessary at the runner end of the casting.

Planing Machine Tables.

The author at one time rammed such castings at one end with what are known locally as "fountain gates." Fountain gates require much skill to put in properly, but no matter how done, a fair amount of risk is always associated with them, for if they are too near the sides dirt is liable to get in the machined parts, which is a sliding surface. The method does not appeal to the author as being a clean way of running, unless they are fed from a receiver. After discarding this method, the author ran them from the middle of the top with round gates through the cores. This method gave excellent results, as the gates were some distance away from the sliding surface.

The number of gates required is determined by the weight of the casting. A good rule to follow is to put on too many rather than too few, as the running can be regulated by covering a portion of the number with stoppers, and others with pieces of tin provided with small holes running through the centre and fastened down with sprigs. This enables the runner box to be full before much metal enters the mould, and prevents the dross from entering.

Large Uprights for Slotting Machines.

When these castings are provided with a deep foot they are best run from the opposite end to the foot, as it largely saves the strain at the deep end.

Large Face Plates for Lathes

Up to 8-ft. diameter, which are made in sand from patterns, are run with round gates on the top about midway between the boss and the run. Others, however, are made in loam from strickles. For these the author had to put in-gates built in the brickwork on the outside, level with the bottom of the mould, and then run out of the reservoir, which is built up separately and covered with a small loam-plate, and the whole cast with the down-gates.

Large slides for lathes and other castings that require to be machined all over the top and bottom are best run from a reservoir.

Planing Machine Cross Slides.

Cross slides for planing machines are run on the top at one end with small round gates, if there is sufficient space between the gates and the machined parts. If not, the reservoir should be used.

For such castings as are made in sand and are run from a receiver, the block for the reservoir is rammed up with the pattern, with an ingate connecting it to the bottom of the pattern, and the down gate is rammed on the top of the block or is

broken at the joint. The area of the down-gate must be larger than the area of the in-gate, otherwise the object of the reservoir is defeated. Difficulty once arose with 20-in. dia. plated pulleys having a 6-in. deep rim. These were run on the boss, and when machined they were dirty or porous on the rim opposite to the centre plate. To overcome the difficulty they were then run with "V" sprays from the top edge of the rim, and no further trouble was encountered. This method is also applicable to small pulleys having bosses which leave very little sand between the boss and the rim.

Spur Wheel Castings.

Toothed spur wheel castings have also shown porosity in the centre of the tooth directly opposite the arm, and it appeared that there had been too much blacking there, and it had run along the arm with the metal. They were of 3-ft. dia. and run on the boss. As a remedy, the author put a sprig in the centre web of the arm between 3 in. and 4 in. from the rim, which proved effective. Some of these castings are made from strickles in loam, the arms being formed with cores. The teeth were cut out from the solid, and occasionally the same trouble appeared, but was similarly overcome.

A good method for blank wheels with arms formed with cores is to connect the cores at the end of the arm next the rim with a piece of sand half the thickness of the arm at each side of the core.

Engine Castings.

Cylinder covers and piston blocks have been run from a reservoir with continuously good results. Cylinder liners and the like are cast on end and run from the top if there is a clear course for the metal to fall and the mould is dried.

Feeding Castings.

It has been stated that a mould incorporating a large number of cores does not require to be fed on account of expansion of the cores, but after the return of one or two large castings exhibiting porosity after machining or hollow places where the metal has been drawn away by a thick body of metal, the question arises as to whether the above argument holds good. When feeding castings having a good thickness of metal, or for a casting having to withstand steam pressure, it is advisable always to have ready some hot metal for feeding purposes, and to continue feeding as long as possible.

Casting with Two Ladles.

For the casting of a 7-ton job utilising two ladles of 5 and 3 tons capacity and one crane, a thick layer of straw was placed on the top part and a runner box holding 50 or 60 cwt. of metal was employed. The casting in this case was a 48-in. headstock and two stoppers covered with a thin layer of loam, in order to stop the down-gates, were used. The runner box was then filled from the 3-ton ladle. The ladles were then changed, and when the second ladle was in position the stoppers were lifted. The accumulation of air in the mould caused an explosion. This shook the sand from the sides of the runner box, which caused trouble, but fortunately the casting came out successfully. For a second casting, in place of the straw a thick layer of cinders was used with the same result.

Still a third method suggested itself. The in-gates were placed at the bottom of the casting, one on each leg, and were fed by a long spray-gate from the centre down-gates. At each end of the spray-gate an open riser was made through the top part, and bushes were installed almost level with the top of the runner box. When the stoppers were lifted there was no explosion, the air coming through the open risers.

Cross-Slide Castings.

Another casting which presented interest was a cross-slide weighing about 6 tons. It was cast by means of two ladles and two cranes. Gates at each end at the bottom of the mould were cut. Casting was started at the end, fed by the larger ladle. When the contents of the second ladle was added no metal went out of the runner box because the first flow of metal had rushed into the bottom gates at the other end and choked them. The lesson to be derived from this is, unless pouring is started simultaneously with both ladles it is dangerous to put both in-gates at the bottom. It is preferable to run the casting on end from the top, or in the case of a bed plate the gates should be put at one end about half-way up.

Facilitating Egress of Air from Cores.

It is advisable to provide the mould with many ways for the free passage of air, and if a long distance has to be travelled, the author never hesitates to put one or two pipes through the metal where there is no pressure of steam or water and no machining. In this category come castings such as planing machine uprights. In the case of standards for engines, carrying three or four cores, which join together and cut through at each end, some moulders connect all the cores with pipes, and in such a case the air is only taken out at one end. This might result in an explosion through the metal getting into one of the pipes, and obviously giving a bad casting. The author invariably insists on the gas being taken out at both ends, as cases have occurred where the metal has entered one of the pipes, but the air has been able to escape from the other.

Chaplets for Holding Down Cores.

Crossheads for vertical boring machines were usually cast successfully, but in one case it was found that the cores had lifted. The first conclusion arrived at was that the moulder had failed to put wedges on the chaplets. This he contradicted. There was only a $\frac{1}{4}$ in. of metal instead of $1\frac{1}{8}$ in., and on removing the cores it was found that the stems had been wedged but the plates beneath them had sunk into the cores, assuming the shape of a saucer. These plates were made of hoop iron, and were $2\frac{1}{4}$ in. $\times$ $\frac{1}{8}$ in. $\times$ 4 in. long, the stems being $\frac{5}{8}$ in. round iron.

After this experience two plates were placed on the top, and if it was not thought to be safe, the plates were bedded in the cores before they were dried. This method was always successful if they were put in the correct place for the stems. If cast-iron plates were used, a hoop-iron plate was always placed under the stem in case the cast iron broke after contact with the hot metal.

A further illustration is that of casting jobs on-end with a barrel core. Such castings are best fastened at the bottom, as it leaves the barrel free for expansion. Some, when stripped, are crooked in the bore, especially when they have been weighted down from the top, which caused the barrel to bend sideways. If it is impossible to fasten them at the bottom, it is preferable to put a strong fishplate across the top and bolt to the handles of the box, ascertaining that the bolts are provided with a long thread so that when expansion starts the bolts can be loosened two or three threads at a time until the metal has set.

DISCUSSION.

MR. PELL asked for further information as to the chill used on the face-plate for lathes.

MR. BICKERTON stated that the hole in centre of casting was 9 in. dia., and instead of making an ordinary core he made a cast-iron bush, 9 in. dia. and $\frac{1}{2}$ in. thick, provided with a $\frac{1}{2}$-in. wide slot from top to bottom to allow for the contraction of the boss of the face plate. The inside of bush was rammed up with black sand, the outside was washed over with blacking, dried, and cast in like a chill.

MR. PELL asked how far would that chill in the depth of casting. It would not chill in above 32nd of an inch in his opinion, and he failed to see that it would do any good, as the casting would have to be machined afterwards.

MR. BICKERTON agreed the casting might have been passed without the chill, but his reason was that the instructions were that the metal must be of close grain at the boss for boring, as there was a thread to be cut in it.

MR. PELL replied that if it was only to act as a densener it would be thick enough to make the iron of a closer grain to obtain a finer thread. But, as far as he could gather, the thickness of chill used determined the depth of chill in the casting. With reference to long ram mentioned by the author, he had had some experience in

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making rams and square retorts cast on end in the manner described, which incorporated no top plate, but merely a ring over the recess head, and that acted as a runner box as well.

MR. BICKERTON replied that he used a cross head on the top to hold core down and to keep it in the centre and a runner box at one corner, and when casting it he took care to stop pouring soon enough, so that the metal did not run over the top of the box.

MR. PELL asked why a top plate was not used on that job.

MR. BICKERTON replied that there was a feeding head of 18 in. to be cut off, and he thought it was simpler and better to cast it open.

MR. PELL asked if there was any advantage with having it open instead of using a top plate. There are many firms who will not allow for 18 in. to be cut off such a casting unless it was taken back at the selling price.

MR. BICKERTON said they generally took back feeding heads of that size, and allowed the selling price in return; and that, in his opinion, it was better both for buyer and seller, for if the casting was rejected through not being properly fed both would be losers.

MR. SHORROCK said in his own shop he had done the same sort of thing as Mr. Bickerton had been explaining. On the question of the chill, he agreed with Mr. Pell, but he did not take it that what was done really amounted to chilling. It was just a matter of closing the grain.

Casting Temperatures.

THE CHAIRMAN (Mr. Hogg) said Mr. Bickerton had not touched upon running temperatures, and he would appreciate the author's views. Did he believe in running all castings very hot, say, dazzling white, about 1,500 deg. C., or bright white, about 1,400 deg. C., or medium hot, or on the dull side? They were all agreed, he thought, that they got smoother castings by running the metal dull. Mr. Bickerton had mentioned both bottom and top running. He, personally, had run from the top beetler bowls 16 to 18 ft. long, and they had always turned out very clean. He had tried running rollers at the bottom, but he was still a believer in running at the top. Speaking of pulleys, he had the same experience as Mr. Bickerton. They were dirty or porous on the rim opposite the plate, and he changed from running them at the top to bottom pouring. The results were fairly good, but after hearing the lecture he thought he would again try running at the top. Did Mr. Bickerton believe in running fly-wheels on the boss or on the rim? He had tried both ways, and got varying reports, but he thought the best results followed from casting on the rim. Mr. Pell was quite right in suggesting that with such a chill as was described there would not be more than a 32nd of an inch affected, and that it acted as a densener. He was a great believer in putting in a densener provided it was in the right place.

MR. BICKERTON said cylinder liners and gas engine cylinders he ran as soon as he could get the metal from the furnace; but he was under the difficulty at the time that the melting resources were poor. He could not get the metal too hot for the job. With regard to work that had to be machined all over, such as slides and pulleys, he always made it a point to run them just medium. He allowed the metal to come down as hot as possible, then let it wait until it started to "break," and then he ran it. His experience of round castings was that it was better to run them at the top. Where they were machined all over it was not very convenient to run them at the top. When running at the bottom he had a receiver, and if the metal had dirt mixed with it that was kept in the receiver. In other cases, when running them at the top, the dirt was always rising to the top, one kept raking it up and allowing it to come off.

A vote of thanks to Mr. Bickerton was passed unanimously, on the motion of Mr. Pell.

THE ALMA FOUNDRY COMPANY, LIMITED, are being wound up voluntarily. Mr. J. E. Bird, Gluman Gate, Chesterfield, has been appointed liquidator.

British Cast-Iron Research Association.

Lord Weir on Improving Trade.

The annual general meeting of the British Cast Iron Research Association was held in London at the Institution of Mechanical Engineers, last Thursday. Lord Weir presided and proposed the adoption of the first annual report which covered the period since the Association was incorporated in 1921. The report claimed that the Association existed to promote co-operation among iron founders with a view to carrying out industrial and scientific investigations relative to the production, treatment, manufacture and uses of cast iron.

Lord Weir said, as to the necessity of the Association, there was not a shadow of doubt as to its ability to meet the needs of the industry. There was no more useful field for research than was available in the iron foundries of the country, and the Association might reasonably claim the strongest support from the foundries. No association could be a success if it had to deal with an inarticulate industry, nor could co-operation be promoted without enthusiasm and keen interest. Lord Weir added that he was alive to what was restricting their trade to-day—the povery of some of their foreign customers. He was quite conscious the depression would not lift unless they themselves played a big part in lifting it by better processes and methods, by making fewer bad castings, and by decreasing their costs and so reducing prices to what their customers could afford to pay. In no branch of engineering was it so difficult to obtain a reliable explanation and effective permanent cure for any specific trouble than in connection with foundries. There were signs of a slight improvement in trade, a quickening of activity, but to a large extent it rested upon their own efforts, especially by brains and systems against any rule-of-thumb method. They should not be afraid to put up establishment charges if by so doing they could bring down the total costs.

The report was adopted.

In order to have a better geographical representation the following were elected to the council:—Messrs. J. Haigh (Wakefield), Major J. S. A. Walker (Wigan), N. B. Ellington (Chester), Major C. Howl (Tipton), S. H. Russell (Leicester), W. R. Bates (Irthlingborough), W. H. Whitehouse (Letchworth), T. Donaldson (Southampton) and H. Shannon (London).

Sir Frank Heath, secretary of the Department of Scientific and Industrial Research, emphasised the importance and the value of the work of the Director of Research Associations. His success rested on his ability to interpret the needs of the trade. Members of the Association must extend the possibilities of the Association into the industry. Their industry was up against the competition of America because of the better technique which existed in the foundries of that country. And they were up against the competition not merely of better technique, but up against the competition of new methods altogether.

To illustrate his point, Sir Frank Heath quoted the case of the printing industry. "You would not call the printing industry a laggard industry," he proceeded, "yet in the printing industry there is growing up, and will be placed upon the market, new methods, dealing with type in the production of newspapers and other publications by which type will be produced on a radically different basis from that hitherto adopted. I refer to the extension of the "Photogravure" system of the reproduction of type. I remember when I first saw the process applied to photographs I said you will not stop here. I was swept away with a thousand and one reasons against any extension. I was an ignoramus. To-day that machine exists in America. That is a lesson which every industry ought to bear in mind."

Concluding, Sir Frank said that industries in the future would be conducted upon an extremely narrow margin of profits, and the only possible means of success in the future would be upon a radically different attack upon the solution of the problem, and that was what would give the chance to the ingenious man, the inventive man, the scientific man.

An Apprenticeship Course in FoundryPractice.—XX.

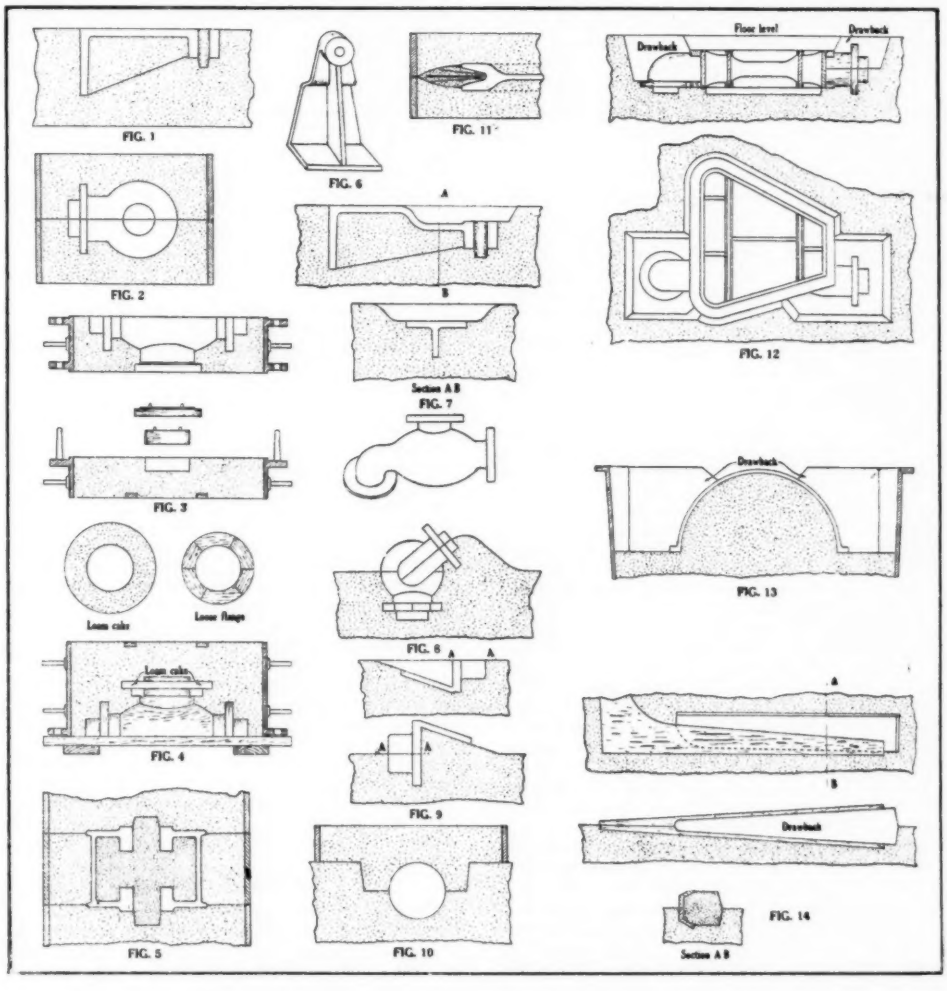
By Ben Shaw and James Edgar.

JOINTING OF MOULDS AND THE MAKING OF DRAWBACKS.

All closed moulds must be separated in the course of their preparation after they have been rammed up. This is necessary in order to withdraw the patterns and also to introduce any cores that are required to give the requisite shape to the moulds. Thus, a mould is composed of sections which, when assembled, form the whole mould, and, just as the division of a pattern into a number of sections to facilitate withdrawal from the sand is known as the jointing of the pattern, so the expression is also applied to the division of a mould. Moulding boxes are jointed, the number of joints depending upon the number of parts into which a box is divided, and each part carries pins or pin holes, in order that it will register accurately, when it is necessary to replace it in its proper relation to any other part or parts. The joints of the box parts may coincide with the joints of the mould, and be on the same plane throughout, or they may have little reference to it except to give a definite level surface, from which the proper joint of the mould can be more readily formed. The joints of the moulding boxes, therefore, provide guides to a certain extent which assist in the formation of the joints for their moulds. The joints of boxes are generally parallel to each other, each being in the same plane. There are exceptional types of boxes which have shaped joints, but these can be used for special work, and their use is limited. The joints of moulds, however, vary with the particular needs of the patterns from which the moulds are to be made. Usually the jointing is governed by the construction of a pattern to be used, yet there are innumerable instances in which the moulder is only indirectly influenced by the jointing of the pattern, when he must determine and fashion his joints to the best advantage with the available boxes or tackle at his disposal. Very closely associated with the jointing of moulds is the use of drawbacks.

Question of Special Equipment.

In the production of standardised castings it is profitable to prepare special equipment in order to reduce the actual labour involved in the preparation of the moulds, for the increased rate of production soon compensates for its additional cost. In such cases, drawbacks are very rarely used. When the number of castings required from any given pattern does not warrant the preparation of special equipment, then available tackle must be employed, and drawbacks are frequently necessary to divide the mould into convenient sections, either for the withdrawal of the pattern and insertion of cores, or in order to render parts of the mould more accessible. These drawbacks may rightly be termed cores when they give shape to the internal parts of a casting, or the expression "false-cores" may be applied when they represent part of the external shape of the mould. But the general term "drawback" is usually applied to those parts of a mould which are lifted separately and without the use of a box part, because they are drawn back to free the pattern or the mould. For work of a repetition character, the skill involved in forming the most



suitable joints is confined largely to the preparation of the equipment for dealing with the work, much time, as well as skill, being used, so that in making subsequent moulds, skill will be sacrificed for speed. On the other hand, when no special tackle is involved, there is the continual need for skill in the jointing of the mould for every casting so produced, the degree varying with the intricacy and sometimes the size of work to be done. The correct jointing of a mould is a fundamental asset, and the faculty for doing so from any class of pattern and for any type of mould is an indication of the skill possessed by the moulder; and the progressive student, realising the necessity of broadening his outlook on this important feature, will take every opportunity of widening his experience, and not be content to be guided solely by the work that comes directly within his scope, but will make himself familiar with the methods adopted for all work, intricate or otherwise, done in the foundry in which he is employed. He should be observant not only of the jointing of moulds, but of all processes and methods by which sound castings are produced.

Flat Joints.

These represent the simplest form of mould joints because they coincide with the joint of the moulding-box and frequently with that of the pattern. The whole mould may be carried in the drag, and the upper surface may be flat and covering the whole area of the mould. The cope in such an instance simply carries a flat body of sand which is flush with the joint edges of the box part. Thus in Fig. 1, which represents the section of a mould for a bracket, the upper part of a pattern should coincide with the joint of the moulding-box, and the sand between, forming the joint, should be perfectly flat. For small and medium-sized work of this character the drag is preferably made in an inverted position on a ramming board as previously explained. The same method is involved in preparing the valve mould in Fig. 2. This is another instance of a flat joint, but one in which the mould joint coincides with that of the pattern as well as the moulding-box. While this method of moulding is suitable, when the divisions in the valve body are vertical to the joint of the mould, many valve bodies have their division plates concentric with the valve, and these invariably need to be moulded with the valve branch in the cope, drag, or middle part, according to the method adopted and the available boxes. In this case three parts may be used, and the two joints may be perfectly flat, as in Fig. 3. When the flange is very close to the body there is greater difficulty in supporting the sand, and a suitably deep middle-part may not be available. The joint must then be varied to suit, and it ceases to be a flat joint.

A deeper box-part may be used to take the bottom half-impression, which carries the valve branch, and it can be rammed up to form one part, providing the branch flange has been cut into segments, so that they can be drawn into the mould after the main pattern body has been withdrawn. This is not a very satisfactory way, and it is questionable whether any time is saved over the preparation of a three-part mould, excepting when the valve is of considerable size. A better method is indicated in Fig. 4. It is useful when the pattern flange fits closely over the core print. During the process of ramming-up, a joint is made about the outside of the flange and flush with it. The loose flange can be stripped and a previously-prepared loam-cake, or core, laid on the joint and covering the flange impression. In this fashion the mould can be completely rammed up. The loam-cake used should be dried, and that part which is to receive metal should be blackwashed. This method preserves the flat joint between the two parts of the mould.

Another instance of the use of flat joints is illustrated in the three-part mould for a shrouded boxed-pulley shown in Fig. 5. This method is only possible when the depth of the middle box part is similar to the distance between the centres of the flanges; otherwise, either a raised or dropped joint becomes necessary. In specialising in the production of such castings, it is better to provide middle parts which will give flat joints, because they can be more easily prepared on a ramming board.

Irregular Joints.

When the joint of a mould must conform to the horizontal surface of its pattern, which is not continuous and in the same plane, such as the bracket in Fig. 6, then the mould joint must be lowered below the joint-surfaces of the box, in order that the cope will take the impression of the whole surface of the pattern. This is one form of irregular jointing, and it is very important that the change in shape from the level surface to the lowered contour of the pattern should be gradual, or, when one abrupt change is desirable, a considerable taper made between the two surfaces. The major part of the joint may coincide with the joint of the box, but the more gradual the depression is made the less is the difficulty in making a clean lift in the cope. Fig. 7 shows two sections of the mould illustrating this form of joint. In other instances the pattern supplied may be jointed, but subsidiary parts made to the joint may necessitate a variation in the mould-joint to accommodate it, or the parts may be set at an angle to suit a required casting. Here there is the same necessity for varying the joint-surface of the mould, one method being illustrated in Fig. 8. It will be noted that the flange carried in the drag is cut for drawing into the mould after the main pattern section has been removed.

Although a pattern may be in halves for convenience in withdrawing from the sand, the joint of the mould does not necessarily coincide with the pattern joint. The two sections in Fig. 9 illustrate the method for jointing the mould for a fair load, the pattern for which is jointed at A. A. When the web is cast in the drag, the joint is lowered and an increased lift made in the cope, whereas the alternative method reduces the lift. The need for irregular joints is common, whether the moulds are made entirely in boxes or prepared in the floor and simply covered, with this difference, that frequently when the latter method is used only a comparatively shallow cover-box is employed carrying bars which come very near to its joint surface. Because of this it is necessary to drop the mould-joint in order that any impression required to be carried in the cope, other than a flat impression, will project from the joint-surface of the cover-box. Thus, in cylindrical work, it is frequently necessary, owing to lack of box equipment, to set the pattern into the foundry floor, so that its highest parts are flush with the floor level, and the joint of the mould must be carried to its centre, as shown in Fig. 10, the cope impression projecting from the cover-box and supported by lifters or grids. Care must be taken when making sunken joints of this type to keep the joint level with the centre of the pattern and for a reasonable distance at each end of the pattern before the change is made to the box joint level. This is necessary to prevent an acute corner in the cope lift, which is a weakness in a joint which should be guarded against in all forms of moulding.

The Use of Drawbacks.

Drawbacks are particularly associated with moulds which are prepared in the foundry floor, or in cases more or less permanently located in the foundry floor. They are nevertheless used when necessary when the moulds are prepared in boxes, although not to the same extent. Their special advantage is in forming loose parts of moulds to reduce the necessity for many box-parts. There is also a saving in pattern or core-box modifications, which would otherwise be necessary in many cases if no drawbacks were to be made, and, incidentally, they give a certain amount of freedom to the moulder to vary the preparation of his mould according to the tackle at his disposal.

A very common type of casting for which a drawback or false core can be profitably used are sheaves or pulleys for chains and ropes. They can, of course, be made in three-part boxes, but two-part boxes are usually sufficient for the purpose, providing the central part of the mould is jointed and carried as a loose piece in the manner indicated in Fig. 11. In this instance the loose part of the mould, necessary to free the pattern, is not lifted separately, otherwise it would need to

be substantially rodded, but it is supported by the drag until the top half pattern is withdrawn, the cope returned and the whole mould inverted, so that the loose-piece may rest on the cope, when the drag is lifted for the withdrawal of the remaining part of the pattern. The loose-piece should be well nailed and vented. This method is suitable for sizes of pulleys which, when made in boxes, can be easily turned over; for larger ones it is customary to make a block pattern and use sectional cores, or sweep an impression to receive cores for the arms as well as the groove about the periphery.

Drawbacks are frequently made when the lift to be made with the cope is excessive, when there would be a possible danger of its collapse when turning over, or when an unnecessary amount of lifting or gridding would be necessary to support it, and also when there would be difficulty in closing the job, owing to the parts of the mould engaging before the guide pins register their correct relative positions. In such instances, the deeper parts of the lift are prepared as loose pieces or drawbacks, so that when the comparatively flat cover is removed they can be lifted separately to free the pattern. Such an instance is illustrated by the section and plan of a mould for the water-end of a condenser, shown in Fig. 12. Here it will be noticed that drawbacks are used to form the cover for each branch, and the joint for the cope is dropped below the floor level, so that a better body of sand may be carried in the drawbacks.

In preparing the moulds for large semi-circular castings, having joint flanges which must be cast in the bottom, it is necessary to make use of drawbacks, particularly when the mould is prepared in the floor. The pattern may be of such a character that the main core can be made in the mould, as shown in Fig. 13, but whether the core is made from the pattern or separately, it is necessary so to joint the mould, not only to free the pattern, but to give access for sleeking or blackening. The drawbacks, in such instances, are usually separated from the pit or case until they are assembled preparatory to casting, when sand is rammed behind them. To enable them to be lifted, bottom-plates are preferable, and thin cast-iron plates may be set up vertically at both ends at the back of each drawback, against which the sand can be rammed.

In some classes of work it is preferable to make the pattern similar to the required casting, because of the difficulty of obtaining a reliable shape otherwise, and instead of boxing up the pattern and providing core boxes, cores are made in the form of drawbacks. This method is frequently desirable with large steel castings, an example of which is shown in Fig. 14. It will be noted in this instance that the drawback is raised above the joint of the pattern and the main part of the mould.

When the cope is removed, half of the pattern can be lifted; the remaining part of the pattern can only be withdrawn after the drawback has been removed.

The majority of moulds for large work, which are prepared in pits or cases, depend largely upon the utility of drawbacks, which facilitate the removal of pattern sections and give access for cleaning the mould and introducing cores.

MR. R. BELL, of 73, Drury Buildings, Water Street, Liverpool, has been appointed agent in Liverpool and the North-West of England for National Alloys, Limited, of Ilford, Essex, for the sale of their "Altior" alloys of bronze and white antifriction metals.

British and American Capital Investments in Hungary.—Owing to the heavy depreciation of Hungarian currency more and more British and American capital is finding its way into the country. Thus, for instance, the American Morgan group has come to an agreement with the Manfred Weiss concern of Budapest, owning large ironworks on the Csepel Island in the Danube, to have their works thoroughly modernised. An unnamed British firm of makers of ventilators are to erect large works in Hungary for the sale of their manufactures in South-Eastern Europe and the Balkans. Mr. Harriman, the President of the United American Shipping Line, has arrived in Budapest with an American leading banker with a view to forming an American-Hungarian Shipping Company.

Nitrogen in Iron and Steel.

An academic research of great practical interest has been conducted by two German workers, Messrs. F. Wüst and J. Duhr, at the Kaiser Wilhelm Institute, and published in the second volume of the communications of this body.

After reviewing existing methods for determining nitrogen in cast iron and steel, the authors give a comparison of the quantities found by other workers. The authors condemn the Nessler method and have used those based on the conversion of nitrogen to ammonia by the action of a suitable solvent, which is titrated with a normal solution of H_2SO_4, using iodine or an ether solution of iodeosin as an indicator. Results for cast iron were 50 to 100 higher when using the former, as hydrocarbons do not interfere, as they are shaken into the ether layer in the iodeosin method. A number of finely powdered materials were subjected to a temperature of 900 to 1,025 deg. C. in a nitrogen atmosphere for several hours, and the quantity of nitrogen absorbed was determined by the iodeosin method. It was found that pure iron had taken up 0.02 per cent.; pure chromium, 9.81 per cent.; manganese of 97 per cent. purity, about 7 per cent. Nickel and molybdenum were both free from nitrogen. Amongst other conclusions reached by Wüst and Duhr was that the nitrogen content of puddled iron varied directly with the duration of the process. The pig-iron used contained about 0.0011 per cent., and the final product 0.0035 per cent. Dealing with the Talbot process, the nitrogen content is the same at the beginning as at the end of the process, and is returned at 0.002 to 0.003 per cent., though in some types of steel it may have been higher at some point during the heat.

Mild electric steel, in a Röchling-Rodenhauser induction furnace, taken in the liquid from the Talbot furnace, showed that the nitrogen content is raised to 0.004 per cent., whilst chromium and high carbon steels so treated increased considerably during this refining process, the former finishing with 0.005 to 0.008 per cent., and the latter 0.009 to 0.012 per cent. nitrogen. The nitrogen content is influenced by the additions; for instance, recarburising with coke increases the nitrogen from 0.002 to 0.010 to 0.012 per cent., whilst slag additions decrease and ferro-silicon reintroduces it. When experimenting with the basic Bessemer process the authors found that the nitrogen content (0.011 to 0.021 per cent.) was not affected by either solid or liquid deoxidisers.

It was also found that the nitrogen in iron does not exist as a cyanide, and no support was given to the theory that ferro-silicon acts as a carrier. From their experiments Wüst and Duhr conclude that the nitrogen is introduced into Bessemer steel by the air blast.

THE EDINBURGH CORPORATION have accepted the tender by the Leeds Forge Company, Limited, to supply 56 double-decked electric cars at a cost of £40,600.

Permanent Way Material for Portuguese West Africa.—A cable from Johannesburg states that two orders for Angola, the total contract sum amounting to £385,000, have been secured by Messrs. Robert Hudson & Sons, of South Africa, representing the firm of the same name of the Gildersome Foundry, near Leeds. The orders are for the supply of permanent-way material, including British steel rails. The first contract is for the extension of the existing Loanda Railway and the second for a feeder line.

Manchurian Steelworks.—Although the report of the American mining engineers who recently inspected the Manchurian coal and iron fields has not yet been made public, it is learned that as a result of their investigation, the South Manchurian Railway Company will proceed with their original plan of erecting a large steelworks in the Far East. The scheme as reported contemplates a consolidation of the Anshan Iron Mines and Steelworks operated by the South Manchurian Railway Company with the Penchihu Colliery and Steelworks, a Chinese-Japanese enterprise controlled by the Okura interests of Japan. The low-grade iron deposits in Manchuria are expected to yield profitable returns. The plant will be able to furnish all the steel products required for the extensions of the South Manchurian Railway system, the Chinese Eastern and Siberian railways, as well as other enterprises in China proper.

Institution of British Foundrymen.

LONDON BRANCH.

STEEL FOUNDRY PRACTICE DISCUSSED.

An ordinary general meeting of the Branch was held at the rooms of the Institute of Marine Engineers, Minories, London, on November 2. Mr. H. O. Slater (Past Branch-President) occupied the chair (in the absence of the President, Mr. Wesley Lambert, who was unable to attend through illness), and expressed his sympathy with Mr. Lambert. He then called upon Mr. F. A. Melmoth to read his Paper entitled "Notes on the Development of the Manufacture of Steel Castings."*

Maximum Aluminium Allowable.

THE CHAIRMAN, in opening the discussion, said that Mr. Melmoth had put his points very clearly and concisely. When dealing with metal composition, Mr. Melmoth had referred to what he termed an excess of aluminium, and he (the Chairman) would like to know what he regarded as an excess. With regard to sand, it was his opinion that the author had skipped rather too quickly over that part of his lecture. Therefore, if the author would give them some of the mixtures of sand used, their names and compositions, he would very much appreciate it. Another point that interested him was cracking of steel castings. Did the author find that in some of his most intricate work it was almost impossible to eliminate the cracking unless the work were knocked out and put into a muffle, and allowed to cool that way?

Titanium in Steel.

MR. V. C. FAULKNER said that the Paper threw further light on a discussion they had had at the last meeting of the Branch, inasmuch as it had dealt with the "life" of metal, and the author's remarks confirmed Mr. Lambert's experience that temperature does not drop rapidly, but if liquid metal were allowed to stand, it would lose some of its life. With regard to the use of titanium as a deoxidising agent, when he had used it—perhaps it was not of the same quality as that used by Mr. Melmoth—he had found that it gave very hard spots in the castings in the machine shop. If he remembered aright, the quality of titanium he had used was poor. As to sands, he did not know whether they were aware of the fact, but quite a number of steel-casting firms had installed driers, in order to ensure that the sand which was the base for the work was perfectly dry. He knew that Messrs. Edgar Allen and Messrs. Thwaites did that. Under the heading of welding, Mr. Melmoth had said that the weld should have 80 per cent. of the ultimate strength of the metal of the casting. Usually, unless welding was followed by heat treatment, it was found that the weld was quite satisfactory, but that the material just at the side of the weld was very weak, and stress would result in the breaking of the material at the side of the weld. To put it practically, the material at the side of the weld had been burned. He had been very interested in Mr. Melmoth's general remarks, because the latest advices from America showed that, whilst the trade was only improving very slightly, there was already a dearth of skilled moulders, and Mr. Haigh, in his presidential address to the Manchester Branch, stated it as his opinion that, as soon as trade did get a little better, there would be a similar lack of moulders in this country.

Foundry and Drawing Office.

MR. C. A. OTTO said he was particularly interested in that part of the lecture where reference had been made to the design of a casting. He believed there were opportunities for the best type of boys working in the foundry to be drafted into the drawing office. He knew of one extensive works in the North of England where that practice was adopted. Occasionally a boy from the pattern shop or from the foundry was given an opportunity to transfer into the drawing office. The only disadvantage he (Mr. Otto) had found in that connection was that it meant that the better class of boys, who would really be more useful in the foundry trade, were taken into the drawing office and left the foundry entirely. Nevertheless, he believed such a scheme was advantageous to the foundry, because the boy who had been trained in the foundry was not taken out until he had had a good training in the principles of foundry work. He had attended evening classes, and had studied mathematics, geometry, drawing, etc., in order to qualify himself for a position in the drawing office, and had kept himself alive to the work of the foundry, in order that he might stand above other boys, and get an opportunity of being pushed forward. In doing so, he had become an expert moulder, or was on the way to becoming one. Finally, he asked Mr. Melmoth whether webbing was resorted to in mild steel castings which he produced, or whether he overcame the difficulty of unequal thicknesses by means of denseners?

Foundry Economics.

MR. G. C. PIERCE, dealing with general conditions in the foundry industry to-day, and the conditions under which those engaged in the industry had to work, remarked that Mr. Faulkner had said on a previous occasion that boys liked to go into the foundry because of the pyrotechnic display, and did not dislike dirt. He himself held an entirely different opinion, but felt that he would be out of order in discussing the subject. However, he would ask whether the author had considered how far the economic position of the foundry workers of to-day affected the question of its staffing with intelligent boys.

Carbon Content and Heat Treatment.

MR. C. CLEAVER, referring to the table of heat treatments and tests, said that, in the first place, taking the carbon content, he was under the impression that there was a definite annealing temperature for each point of carbon above a certain amount. He had noticed that the heat treatments of steels containing 0.16 per cent. and 0.24 per cent. were both at 900 deg. C. He had noticed also that with two steels of practically the same analysis (Nos. 5 and 6 in the table) there was a very wide difference between the yield points, one being 16.9 tons per sq. in., and the other 23.4 tons per sq. in., a difference of 33 per cent., and it did not appear to him that the steels could be uniform, although the analyses were comparable. He asked whether the author could say what had caused the difference.

Technical and Practical Co-operation.

MR. A. R. BARTLETT said there was one point that appealed to every foundryman, and that was the question of design. The weak point in connection with design, from the foundry point of view, was that they did not have a sufficiently close co-operation between the technical man and the practical man. The technical man, who thought he had all the knowledge that was necessary in order to enable him to get what was wanted, never asked the opinion of the practical man, because he probably thought the practical man knew something, and would pull him (the technical man) over the coals on some point which he (the practical man) looked at from the practical point of view. The practical man had the same timidity in approaching the technical man, because he felt he had not all the technical knowledge that the latter had. If they met on common ground, and had a common regard for one another, probably some of the difficulties of design would be overcome. With regard to the training of apprentices, that was always a sore point. They wanted to make better craftsmen, but there was a great deal of specialisation and standardisation, and when a man entered a specialised line of business he would not make a craftsman, but would develop into a sort of machine. The greatest difficulty they had to face at the moment was that the commercial side of the business must be considered; they must make things cheaply, and in order to

* This was published in the FOUNDRY TRADE JOURNAL for November 2, p. 355.

do that they must go in for specialisation and standardisation.

Fluidity.

MR. E. H. BROWN, referring to fluidity, said there was much discussion taking place as to what were identical analyses. There were several elements which entered when dealing with steel, such as oxygen and nitrogen, and chemists were practically unanimous that there were no accurate means of determining them. Therefore, was anybody justified in saying that analyses were identical, having regard to the fact that there were sometimes included minute proportions of one of these, or other elements which were not estimated in the ordinary way? As to foundry training, he referred to his experiences on Tyneside. There he had interviewed about 60 boys during a year with regard to their employment in the foundry, and only two of them would even hear of going into the foundry at all. They usually said, first, that the foundry was too dirty, and, secondly, they considered that the foundry trade was a minor one, and that there was no future in it. He had tried to get boys with secondary school education into the foundry, but there seemed very little chance of this at present, unless they could do something to improve the foundry trade and make it appear in a better light. The machinist had the pick of the boys coming into an engineering works. He suggested that something might be done during their last few years at school to encourage them to go into the foundry. He suggested they might be shown films, in order that they might see some of the interesting work of the foundry, and then they would have a chance of considering it for, perhaps, two years before taking up the work. With regard to taking boys from the foundry and transferring them to the drawing office, this had the advantage of stimulating other boys in the foundry to improve themselves. Dealing with sand, he said that he had noticed during the Liège conference that one firm—he believed it was Messrs. Fondéries de l'Esperance-Longdoz—were turning out steel castings in green sand, and were endeavouring to utilise the old sand repeatedly and to maintain the sand practically entirely of a composition suitable for facing work. If they could do that in Belgium, we in England should endeavour to utilise our sand similarly, and to maintain it in the same condition.

Crucible Steel Castings.

CAPT. LINDSAY (a visitor) said the author had dealt too summarily with the manufacture of steel castings in crucibles. His statement was correct when applied to manufacture on a large scale, but he believed that it required qualification in so far as it applied to the manufacture of steel castings on a small scale. There he believed crucible melting was worthy of attention. He mentioned it at that meeting because, after all, in the London district the manufacture of steel castings on a large scale was not taking place, unfortunately. For the successful manufacture of steel in crucibles the nature of the furnace was of first importance. The crucible steel furnaces in use to-day were largely deficient in design, and he believed Mr. Melmoth would bear him out when he said that the coke consumption of these furnaces was excessive, the furnaces sometimes using 2 to 2½ tons of coke per ton of metal, whereas, with efficient forced-draught and correct distribution of air in properly proportioned furnaces, the fuel consumption could be as low as one ton of coke for one ton of steel. Under those circumstances steel could be produced at £10 or £12 per ton, and, where there was a limited demand, that was still an attractive proposition. The converter and the electric furnace, of course, played their part the moment the demand was sufficiently high, but for a small demand they all knew that those furnaces could not be operated economically and intermittently; therefore, the economic argument that militated against the use of crucibles for large demands was favourable to crucibles where the demand was small. He was referring particularly to the user of steel who wanted to make his own castings.

MR. A. F. GIBBS asked for a little more light on the subject of heat treatment. In the first place, he did not know what substances were used for packing, but he took it that the author used a neutral substance, such as sand. Again, did the author have any trouble with warping during annealing? He would like some information as to the rate at which the temperature was raised in the annealing furnace, and also the rate of cooling. With regard to the table of results, he had noticed that in the second sample the percentage of manganese was rather high. He would have expected, with such a percentage of manganese, a rather higher tensile result. He was wondering whether that had anything to do with the grain size.

THE AUTHOR'S REPLY.

Amount of Aluminium Necessary.

MR. MELMOTH, in reply to the discussion, dealt first with the Chairman's remarks. As to the quantity of aluminium which he would regard as an excess, he had not mentioned a figure for that at all, but the usual practice, for electric-furnace steels, was to add a very small amount, probably somewhere about ½ lb. per ton of steel, in the ladle, and that was really added as a surety. He had cast large numbers of castings without aluminium from electric-furnace steel. For converter steel they would probably use 1 to 1½ lbs. per ton of steel in the ladle.

Preparation of Sand Described.

With regard to sands, he had not entered into detail purposely, because on every one of the headings in the Paper it was possible to occupy nearly the whole of the time available for the whole Paper. If the matter were of interest, however, the first thing to consider was the basis sand, and the finest basis sand he had found so far was Leighton Buzzard. It could be obtained in any quantity, it was wonderfully regular in grain size, and the most serious element, *i.e.*, fine dust, was almost entirely absent. Also, it was remarkably free from clay. Taking a sand of that nature, *perfectly dry*, at his foundry, they milled with it about a quarter of its bulk of the Cornish sandy loam mentioned in the Paper, which latter was obtainable in large quantities from Cornwall. They milled for about 5 to 10 minutes, and thereby produced a sand which, for green-sand steel castings, was the best they had found. If a finer finish were required, finer grades of silver sand could be used with the Leighton Buzzard. For dry-sand work they were in the habit of using old sand which had been passed through a renovator, which removed the dust almost entirely, and brought the sand down to a regular-grain size. To that they added a small proportion of Mansfield sand, together with a little binder, and milled for 5 to 10 minutes, and they had not found anything superior. They had tried other sands, but without any great success. They had given up the idea of using local supplies at the moment.

Cracking Troubles.

With regard to cracking, he was afraid that the Chairman would find, in his (Mr. Melmoth's) particular foundry, there were difficulties. There were mass-production methods. On full output they were producing from about 12,000 to 15,000 different castings per week in mild steel, and it would be found almost impossible to knock them out and put them into a muffle to cool. There was very little need for knocking them out hot and putting them into muffles—at least, with those with which he had dealt. In dangerous cases, the standard practice was to release all risers immediately the metal was cast. In reply to Mr. Faulkner, the author said that on the question of fluidity nobody had made any definite statement at all. He had read all he could find about it, and for over two years he had been trying to find out the fundamental principle. Mr. Faulkner's experience of making electric steel, and finding that when he tapped the steel it had not the expected fluidity, was quite common, and that was the phenomenon which had led him (Mr. Melmoth) to look further into the question. He had found that if they tapped electric steel when it was ready —and he supposed that applied to any metal—

and did not have any delays, they had probably the best possible conditions they were likely to get.

Fluidity Dealt with.

Working conditions in the electric furnace controlled, to some extent, the fluidity of the metal. Some academic gentleman previously had said practically that that was not so, and that fluidity was purely a function of temperature, given identical composition. He was afraid the practical man did not believe it, and he himself did not, from his experience. He sincerely hoped that in the near future the experiments carried out by his firm would be on such a basis that he would have the pleasure of giving the Institution the results. At any rate, they could, to a large extent, control fluidity in the electric furnace.

Low Carbon Titanium Useful.

With regard to the use of titanium as a deoxidising agent, no doubt Mr. Faulkner was working with some of the titanium obtainable before the war, and probably it contained a very appreciable percentage of carbon. He had used titanium, and had never had trouble through hard spots.

The Drying of Sands.

As to the use of a drier for sand, that was obviously the only way to get the moisture content regular. His firm had installed a Thwaites drier, and all their material was put through it. The old floor sand was put into the drier with a small proportion, probably 1 to 4, of new sand. When perfectly dry, it passed from the drier and dropped into a shoot, where it was riddled, and nails and scrap thrown out into a sump. The sand fell into a hopper, was caught by a blast of air, and blown straight up into a large tank. The finest dust went over the top to a settling tank, and by gravity the heavier sand fell into the main tank and was fed to the mills automatically. With regard to the runner for the test bar, if it was carried at its full thickness, or a little over, right up to the test bar, it was distinctly possible that a small draw would occur, through the runner itself drawing metal from the actual test-bar casting. By merely choking the runner they obtained a very much better test bar.

Welding and Heat Treatment.

As to welding, Mr. Faulkner's experiences were quite usual. Any weld which was carried out roughly and quickly was always oxidised round the edges, and it was common practice, and should be general practice, that after any appreciable welding, heat-treatment should be carried out; in most foundries welding was carried out before heat-treatment. An oxidised ring round a weld was a sign that the weld was a bad one. It was largely a question of defective workmanship. With regard to the lack of skilled men, to which Mr. Faulkner had referred, he was afraid Mr. Faulkner knew more about that than he himself did, but he knew that as soon as work did improve they could get moulders, but not the type they wanted, and it was largely due to the chaotic condition of boy training. There were no technical educational facilities for boys in his district, and his firm was finding that one of the most difficult problems at the present time. It was the experience of his own firm that during the war the boys were turned into small machines. They were put on the floor with jobs, of which they turned out two or three hundred, or in some cases two or three thousand, and they turned them out in exactly the same way as machines turned them out. They did not appear to have had very much training of the kind that would make them properly qualified and properly skilled moulders, and as a consequence the time would come when the foundry industry would feel the shortage of skilled moulders very severely.

Training of Apprentices.

Mr. Otto had referred to the taking of boys out of the foundry and putting them into the drawing office. That was all right, but he did not see that that would meet the point. If any initiative on the part of foundry people could ensure that the people engaged in actual designing had previously had to undergo foundry instruction, then a very different state of affairs would exist, but merely putting a boy through so much drawing-office routine, although it would help him in moulding practice, would not improve matters very much. The trouble was that defects in design were not always realised by the designer to be his own fault, but were said to be the fault of the foundryman. As to Mr. Otto's second point, any number of mild-steel castings had to be webbed up to prevent cracking. Chills hardly acted as denseners in steel. Chills were used quite freely on certain types of work, but there was no doubt that they added very materially to the expense of producing a casting, and any steps which could be taken to procure soundness without chills would be all to the good. His firm used a quantity of chills, particularly in places at which it was very difficult to get, such as heavy bosses. In many other cases an alteration in design had got over the difficulty without the necessity for using chills or anything else.

MR. OTTO, intervening, said that when he had referred to the apprenticeship system in vogue in a works in the North of England he should have made it clear that the boys who were drafted from the foundry became permanently established in the drawing office, and they had the opportunity, if they were sufficiently equipped, to become designers. He knew two such men who were designing, and who very rarely found it necessary to go to the pattern shop or to the foundry for their information. They had been trained in the principles of the work, and could follow it out much better than the average draughtsman, who had not had experience in the foundry.

MR. MELMOTH said he had the idea that the boys should serve in the drawing office for a time, and return to the foundry afterwards. He thanked Mr. Otto for correcting him.

More Economics.

Replying to Mr. Pierce with regard to the conditions in the foundry industry, the author said that Mr. Pierce had put the matter in a light that had not occurred to him, but if any industry, or any separate firm in an industry, could not produce a casting economically, and sell it, and, at the same time, guarantee decent conditions for its workpeople and for the boys who were growing up in the industry, then the sooner that firm or industry was out of it, the better.

Practical Heat Treatment.

Mr. Cleaver had pointed out something in connection with quenching temperatures which was somewhat academic. The academic gentleman would probably say that with a steel casting containing 0.18 per cent. carbon the A^3 point was 875 deg. C., and that if they heated to a temperature of 880 deg. C. they were 5 deg. over. For 0.22 per cent. carbon he would probably say the A^3 point was 860 deg. C., and if they heated to 870 deg. they would be over it. But in ordinary practice, said the author, the difference in temperature between 870 and 900 deg. for mild steel castings could not possibly do any harm. The figures he had given in the Paper were not academically produced; they were not laboratory figures, but were taken under works conditions, and under those conditions they did not expect a difference of a few degrees to make all the difference to the annealing of a steel casting. In the hardening of a high-speed tool steel or, say, an alloy-steel crankshaft, it was necessary, but not in the annealing of a mild steel casting. With reference to the point Mr. Cleaver had raised with regard to the yield point, that was obviously wrong, and was probably due to the fact that he had hurried when preparing his paper. A yield point of 16.9 tons per sq. in. was too low for such a steel, and it should have been in the neighbourhood of about 18 tons. However, it was probable, with regard to the figure of 16.9 tons, that the person carrying out the test got a false reading.

Effect of War on Training.

At to Mr. Bartlett's remarks with reference to co-operation between technical and practical men, there was, no doubt, a little fault on both sides. The practical man had a very great distrust of the highly technical man, until the latter attempted to meet him, but after that he would meet the technical man never less than half way, and in several cases he had met him a great deal

further. It was his own experience that the practical man would help the technical man, and it was only a case of going about the problem in the right way. The technical man who said he could carry on without the help of the practical man was romancing. With regard to specialisation, he believed Mr. Bartlett had misunderstood him. He (Mr. Melmoth) was grumbling about the fact that many boys were put on purely repetition jobs during the war. That was a very great error, and would have the effect of robbing the boys of nearly five years of the varied experience which he believed Mr. Bartlett would insist upon their having. He was not suggesting that that was the right way to handle boys; it was wrong. It was forced on firms under war-time conditions, but the moulder of the future would not be quite the man he was before those conditions obtained.

Belgian and British Sands.

Mr. Brown, in discussing fluidity and identical analyses, had said that because they did not know enough about a thing it was not worth while saying anything about it. On the contrary, it was only by discussing such problems constantly that they would ever know anything about them. With regard to the use of green sand over and over again in Belgium, Mr. Melmoth pointed out that green sand depended for its bonding properties on clay. If they baked clay they destroyed the water in it, and got nothing but silt, which became cumulative, and for steel castings it was even more important than for iron that the sand should be very open and porous. Mr. Brown has also suggested that it was curious that we could not do something to grade our sands in the same way as the Belgians graded theirs. That was a physical impossibility. The Belgian sands were naturally bonded, but in this country the naturally bonded sands were not of sufficiently open grain, in the silica portion, to be used for steel moulding. At any rate, if they were, he had never had any of them. Silver sands allied with a clay were the only moulding sands which were successful here for green work.

Cost of Crucible Melting.

He welcomed very much Capt. Lindsay's contribution to the discussion. His own firm had started their foundry as a crucible steel casting foundry. Capt. Lindsay was correct in saying that the old type of furnace, probably the Sheffield type, the 2 or 4-pot furnace, with ordinary induced draught, was very expensive to run, and no doubt his figure of 2 tons of coke per ton of metal melted was on the moderate side. On the other hand, the coke consumption figure for the latest type of Morgan furnace, which was a forced-draught furnace, and was recommended for melting steel for mild steel castings, was 30 cwts. per ton of metal melted. Even at 30 cwts. per ton it became a fairly expensive business. Capt. Lindsay was right when he had said that for small quantities that was a sound proposition. Certainly it was for those wishing to make their own castings in small quantities, but he would not like to go into the steel castings trade with crucibles. He pointed out that prices are falling. He had seen some very beautiful castings indeed made from crucibles, and he had no doubt with regard to either the material or the castings obtained from them, but he did not think that a foundry, as a profit-making business, could be run now on crucible lines. Another point was that they limited materially the size of the casting they could make, although they could double up if they wanted to for medium weight jobs.

Annealing Explained.

He was very much afraid that Mr. Gibbs was thinking of mild steel castings a little in terms of malleable when he had referred to packing, etc. The ordinary method of annealing mild steel castings was merely to raise them to temperature inside a furnace; they were placed inside as and when convenient, but a little consideration was given in the placing of them to any possible warping due to uneven heating or possible sagging of uneven portions. There was no packing required at all, because the actual heat treatment was not a chemical one; it was purely physical, purely a case of re-crystallisation. The as-cast structure which existed in the form of coarse crystals was heated to a temperature at which it should become a solid solution, and re-crystallised to a finer grade, the fineness of the grade being dependent on the temperature to which it had been heated. He had dealt with the question of warping, but many castings, variable in type and of variable thicknesses, had often to be packed up with pieces of brick in order to prevent sagging. The question of the rate of heating up of very mild steel castings were almost immaterial, but the cooling down depended very largely on the type of casting again, and was largely a function of mass. In the case of heavy casting it was obviously better to allow the casting to cool slowly in the furnace, but a large number of these small castings were cooled down in air from 900 deg. C. without developing defects. With regard to manganese content, that was not by any means too high, unless these steel castings were used for electrical purposes. For electrical purposes it was advisable to keep the manganese content down to about 0.35 per cent.; the carbon and manganese, in these cases, should always be kept as low as possible, whilst the effect of silicon appeared to be rather beneficial.

Dealing with the influence of manganese on grain size, Mr. Melmoth said that the tendency was for manganese to reduce the grain size in the as-cast condition.

Brinell Scleroscope.

MR. E. H. BROWN asked whether there was any advantage in using the Brinell test over a scleroscope reading for testing steel castings, or whether the scleroscope offered as good a test for comparative purposes as the other.

MR. MELMOTH said that he, personally, had not used the scleroscope on any mild steel castings, but, knowing the instrument, he saw no reason why comparative tests should not be obtained in the same way. The value of most of these tests existed absolutely in the fact that they were comparable, and the scleroscope should be just as good for comparative purposes as the Brinell.

MR. FAULKNER said he had found that the scleroscope gave a reading varying with the thickness of the section on which it worked.

MR. MELMOTH said the minimum thickness of a steel casting was about ¼ in., and he did not think any one would hesitate to apply the scleroscope test, assuming ¼ in. thickness of metal, and in this case they need not anticipate any appreciable movement of the metal which would affect the scleroscope test.

Cinema and Training.

THE CHAIRMAN said he was impressed with Mr. Melmoth's reference to the handling of the sand by machine instead of by hand, which was very hard work as a rule. With regard to the point raised as to the use of the cinematograph for the education of the moulder, or any other craftsman, he reminded the members that when they visited the Rugby works of the B.T.H. Co. they were shown the complete method of producing a steam turbine. That was most instructive to some of the old members of the Institution, and the cinematograph could very well be used by technical institutions to carry out the education of those who were going into the foundry.

He suggested that the Hon. Secretary should be asked to send a letter to Mr. Lambert, the President, expressing the sympathy of the members in his indisposition, and wishing him a safe voyage to America, and a successful time there.

Vote of Thanks.

MR. J. ELLIS proposed a very hearty vote of thanks to Mr. Melmoth for his very able lecture. It had been well discussed, and they owned Mr. Melmoth a deep debt of gratitude for taking so much trouble to prepare it for presentation to the members. He himself was delighted that Mr. Melmoth had introduced the question of the training of boys. That question had been worrying the Institution for a good many years. As the lecturer had said, boys would not come into the foundry, at least the right type of boys, but he was more than confident that, if they once got a boy into the foundry and gave him a fair run, he would find the trade fascinating, and if boys were

treated fairly the foundry trade would get a good number. Again, he considered that employers ought to be more public-spirited. Boys were being educated in the foundries, but if they progressed rather rapidly they left, and went to another foundry for an extra two shillings a week. If the employers were public-spirited, they would realise at once they were doing a national work. They had the same chance of getting the boy from the other foundry, and he urged that every boy should be given a chance, and not kept on one class of work too long. Undoubtedly there was a great dearth of good moulders, and he often wondered how far the moulding machine was responsible for that. At the same time, there were some classes of work for which, he supposed, they would never be able to do without good moulders. There was an illustration of that at Messrs. Fraser & Chalmers' works, which the members of the Branch had visited in the previous month. Everybody would agree that there was certain work there which could never be put on the moulding machine, and therefore the moulder had something to look forward to as a really skilled craftsman.

MR. A. R. BARTLETT seconded. He had noted with very great pleasure, he said, that the lecture had drawn out a very good discussion, and that there was a fairly good gathering, which was all to the good, because he did not want it said that the London Branch was run by one or two people. He had noticed that in THE FOUNDRY TRADE JOURNAL recently somebody had remarked that people wanted to discover themselves; some of those present that evening had discovered themselves, and had given their opinions to others, which was helpful.

The vote of thanks was accorded with enthusiasm.

THE AUTHOR, in thanking the members for the vote of thanks, said it had been a pleasure to give the lecture. He hoped he would have the pleasure of addressing the members of the Branch at a future date.

The meeting then closed.

NEWCASTLE BRANCH.

At a meeting held on October 28 Mr. Percy Longmuir, D.Met., of Sheffield, gave a lecture on "Iron, Steel and Brass Founding," with lantern illustrations. Mr. H. J. Young, F.I.C., Branch-President, was in the chair, and, in introducing Dr. Longmuir, congratulated him on his appointment as Director of Research to the B.C.I.R.A. He had been chosen out of a large number of applicants, and it was one of the most important positions in this country at the moment.

IRON, STEEL AND BRASS FOUNDING.

DR. LONGMUIR commenced his lecture by saying that he wanted it to be more like a friendly talk, going from one aspect of foundry practice to another. He felt that in each member of the Institution he had a friend, and that he could get any help he needed from the foundries of this country.

Pre- and post-war there has been a great deal of talk as to the excellence of the German product, but in his travels from the North of Sweden down to Italy he, personally, had not come across moulders of the calibre of the Scotch and English moulders, and considered that the castings produced in Great Britain were most excellent. The Continental countries have spent more money on universities and research work than have the people in Britain, and it is on the academic side that our Continental friends have got ahead of us. Sheffield until last year had never had foundry teaching at all, but by establishing a Trades Technical Society the first step has been taken towards having a foundry course in the University. Although very little of the research actually done in foundry work during the war can be referred to, there are many excellent papers which should be studied by all those connected with foundry management.

Loam moulding was the first type of moulding practice, and the bronze castings made in the very early days would probably be moulded in loam, but undoubtedly the bronze age in Britain had passed into the iron age about a century before the first Roman invasion. At Wortley the early iron workings of the Danes could be seen, the iron (wrought, not cast-iron) being directly produced from the ore. The first cast-iron was made in Sussex, with charcoal as the fuel, but progress was not regular until coke was introduced.

Permanent Moulds.

The preparation of a permanent mould is one of the problems in foundry practice that is before us at the moment. As to whether it is advisable to core by means of dried cores or to make a pattern to leave its own cores is another problem, but there is no doubt that dried cores are very useful for machine moulding.

In choosing a moulding sand one has to consider its composition, texture, bonding powers, porosity, as well as its resistance to the action of the fluid metal, which action, however, is not always a question of temperature, and is, therefore, a distinct feature for research.

It is always advisable to avoid oxidation when melting alloys or metals for the mould, and in steel founding this can easily be done.

The fluidity of metals is another question for research, and the effect of superheat on their running power. The lecturer then showed two slides giving the range of temperatures in metals.

Another feature following fluidity and open for investigation is that of liquid shrinkage. In many cases contraction leads to warping, and the lecturer suggested that that could often be modified by the use of gates.

Brass Founding.

Especially in brass founding should the metals constituting the charge be weighed accurately, and any volatilisation losses which could not be avoided should be allowed for before charging.

The lecturer showed slides giving the analyses of the various metals used in brass-work, and said that each one should be at least 99.2 per cent. purity.

Lead should be kept as low as possible in zinc, and the metals employed in brass founding should always be tested for their direct value. He said that all tension brasses contain approximately 60 per cent. copper and 40 per cent. zinc, plus a comparatively low percentage of one other element in the case of manganese-brass, but perhaps two or more in other alloys.

Internal Chill Castings.

The lecturer then showed a slide of black-heart castings, and another slide of which the castings were white in the centre, called by the lecturer white-heart castings, but he did not know what was the cause of the latter.

He then showed a slide illustrating growth of iron bars, some of which had bends in them. Professor Carpenter, at Manchester University, has done a good deal of work on the growth of cast-iron, but it is capable of much further development, especially in castings which have to meet repeated heating conditions. In this connection it may be mentioned that a network structure can either strengthen the mass or weaken it. In pure iron, both silicon and carbon have the effect of lowering the change point.

DISCUSSION.

THE PRESIDENT, in opening the discussion, said that he thought, after hearing Dr. Longmuir's lecture, they all understood why he had been appointed by the B.C.I.R.A. He was glad that Dr. Longmuir had mentioned the Sheffield Trades Technical Society. There were no special classes for foundrymen and boys in Newcastle, and he felt that the local branches of the Institution of British Foundrymen ought to try to do something in that direction in each centre, and not leave it to a trades technical society to do so.

MR. J. W. FRIER referred to the question of the growth of cast-iron, and asked if it had been proved whether a really good iron or an ordinary iron "grew" the most. He was thinking particularly of castings which came into contact with heat, for example, fire-grates and bars.

Manganese Content and Growth.

MR. R. O. PATERSON said, with regard to the question of the growth of cast iron with superheat, that he believed Professor Carpenter had suggested a high manganese-content to overcome growth, but he would like to know whether the manganese itself has any effect, or whether it is that it gives the carbon a different structure in the casting.

MR. COOPER said that he would like Dr. Longmuir's opinion as to why a ladle of converter steel should cool more quickly than another ladle of converter steel, both apparently being at the same initial temperature. Also he would like to know Dr. Longmuir's opinion about the foundries on the Continent, and if he had not found that the workers there were given more encouragement than they are in this country.

MR. C. GRESTY asked, with regard to the effect of silicon on the change point of pure iron, whether Dr. Longmuir had carried out similar experiments on ordinary grey cast iron. His experience had been that, as the silicon-content was increased, the carbon change point was raised, not lowered.

MR. H. J. YOUNG said that the lecturer had stated that silicon lowers the change point of iron, and he would like to ask what would raise it. Also the lecturer had said he did not know the reason for white-heart castings; but did he know the remedy?

MR. LOGAN, in a few remarks, said that he had found the question of the high-tension manganese brass very interesting, but in their work they had found it necessary to consider more than the fracture, and not only analysed the metal, but tried to keep the structure within limits.

MR. PAULIN asked if rapid cooling caused a difference in the structure of the iron, and whether Dr. Longmuir had noticed that iron which has been cooled rapidly has a different colour from ordinary iron when machined, and whether there was any particular reason for that.

Regarding the question of white-heart castings, MR. WHITE said that he had come across the same thing when casting a number of pistons, and had never been able to discover the cause of it, and would be glad if Dr. Longmuir could spend a few minutes on that subject.

MR. FLACK asked, with regard to an ordinary core wheel made of steel with a 0.5 per cent. carbon-content and cast in a green sand mould, why, although the boss was drilled quite easily, the drill would not touch the rim of the wheel.

MR. LILLIE said that he had listened with great interest to Dr. Longmuir's lecture, and he would like to know what the lecturer considered to be a safe arsenical-content for gun-metal work for super-heat steam. Also, did the lecturer consider that 1,173 deg. C. was too high to heat gun-metal? He (Mr. Lillie) had been able to obtain good castings from gun-metal at 1,130 to 1,240 deg. C., giving 16 tons tensile, but, of course, a lot depended upon the type of the casting. Did Dr. Longmuir not think that the tensile properties were reduced during the time that the metal was kept stewing in the furnace? He would also like to know whether the phosphor-bronze mixture was made and then remelted, and whether the test-bars were sand- or chill-cast.

MR. WILKINSON said the point about the casting temperature had been of great interest to him, and he thought that he had read in Dr. Longmuir's book on foundry practice that the proper casting temperature was when the metal would just run out of the ladle, but he did not quite agree with that, as he considered that some metal just coming out of the ladle was not fit for anything but scrap. Foundrymen are always seeking metal that will set or freeze without contraction, and they want a metal that will stand pressure, but up to the present it has been almost impossible to get one without the use of chills.

THE AUTHOR'S REPLY.

DR. LONGMUIR thanked all present for the interest shown in his lecture, and was especially glad that the Chairman had referred to the foundry trades technical classes, as their chief object was to encourage the junior members to take definite courses of evening classes. Before the University can create a course especially for foundrymen, there has to be a demand from foundrymen—a demand from the trade—and he thought that that demand would eventually come, and that, under the guidance of Professor Desch, classes would be formed in Sheffield in the near future. In London there are at least five technical schools where foundry classes are given regularly, and it is remarkable that Sheffield, with all its facilities, had no foundry classes at all. The reading of simple papers is another step towards progress, as this arouses interest in the actual worker, and so feeds the society.

Growth of Cast Iron.

With reference to the growth of cast iron, the lecturer said that it was not altogether a question of whether the iron was good or bad, as suggested by Mr. Frier, but, he believed, Dr. Carpenter had shown that growth was due to the oxidation of the silicon-content in the metal, but he was not certain about that point. He believed that the reason for adding manganese was to neutralise the influence of silicon, but it is a subject, like many others in foundry practice, that one cannot be dogmatic about.

Mr. Cooper had brought forward the question of two ladles of converter steel of the same heat—one cooling more quickly than the other. He could not give the reason for that, unless one of the ladles *was* hotter than the other or both ladles were not of the same composition; otherwise one would expect them to cool at the same rate.

Mr. Gresty had referred to the effect of silicon on the change point of pure iron and the opposite effect on cast iron, but he (the lecturer) had not done any work of that kind on cast iron, though he believed that Professor Turner had done a good deal of work on the subject.

The Chairman had brought up the point that silicon lowered the critical point, and asked what would raise it, but he was afraid that, up to the present, nothing had been done on cast iron in that direction, although a lot of work had been done on steel.

Improvising Standards.

DR. LONGMUIR welcomed Mr. Logan's remarks as to the advisability of analyses, and even microstructures, before tapping the charge. He had mentioned fracture because, in the days when they had not a laboratory, they simply prepared standard chill moulds and cast series of known compositions, had them checked outside, and got a series of standard fractures and compared them with the standards.

The white-heart castings referred to could not be cured except perhaps by keeping the manganese-content high.

As to the core-wheel, he did not know why it should be difficult to drill unless the effect of the green-sand mould had made it hard. Mr. Lillie had spoken about the casting temperature for gun-metal castings, but that depended upon the kind of casting even if poured from the same metal.

With regard to the arsenical-content, he considered that 0.47 per cent. was on the high side, but it was really a question of whether the arsenic would be injurious in large amounts. He had known brass founders to add arsenic to gunmetal to get better results. The phosphor-bronze test pieces he had referred to were made from remelted metal.

He thought that in the book Mr. Wilkinson had referred to it was stated that the correct heat for casting was when the metal would clear the lip of the ladle without leaving any scum. He quite agreed that people are looking for a metal which will give no contraction, and once it is found many troubles will disappear, but after all, there are natural laws in metals as well as in human beings.

Vote of Thanks.

MR. WALLACE then proposed a hearty vote of thanks to Dr. Longmuir. One thing that had impressed him in Dr. Longmuir's lecture was the importance of accuracy of detail. The question of quality of metals reminded him of two ordinary turbine castings made 16 or 17 years ago, when the two halves must have grown, for when they had to be put together they would not meet. There was possibly some difference in the silicon-content of the two castings.

XUM

MR. SMITH seconded, and said he thought the reason for everyone having come to hear the lecture was because Dr. Longmuir, with about twelve more, were the founders of the Institution of British Foundrymen. He was sure they were all delighted to have him there, and fully appreciated his lecture.

The CHAIRMAN, before putting it to the vote, said that the local Branch of the Institution was doing what it could to educate people, and they were having two more educational Papers that session. They were doing their best to impress upon the Universities the necessity for classes. He noticed that members in the brass, iron and steel trades had all taken part in the discussion, and that it was remarkable that Dr. Longmuir had been able to raise questions from so many sources, and he did not think any other lecturer in that branch had ever succeeded in doing this. The British Cast Iron Research Association wanted members, and yet dozens of foundries were waiting to see what the Association was going to do before they would join. Obviously, the less the membership, the less the work done. He sincerely hoped that the foundries on the North-East Coast would be patriotic and join up as soon as possible. The subscription was rated according to the size of the foundry. With Dr. Longmuir as Director, good work would be done—practical work rather than academic,but, of course, a little of both was essential to success in industry.

DR. LONGMUIR, in expressing his thanks for the appreciation shown by those present, said he particularly appreciated the Chairman's kind references to the British Cast Iron Research Association. The Association required tools, and the first tools were members and their subscriptions.

Book Review.

SOME AIRCRAFT STEELS AND MATERIAL. By Brigadier-General R. K. Bagnall-Wild, Leslie Aitchison, A. A. Remington, A. J. Rowledge, and W. A. Thain, with an introduction by Dr. W. Ripper. Published by Messrs. Constable & Company, Limited, 100, Orange Street, Leicester Square, W.C.2. Price 16s. net.

The reason for the collaboration of such a large number of authors is because the various sections of the book were originally a course of lectures delivered at Sheffield University, under the joint auspices of that institution and the Royal Aeronautical Society. The work is specially to be recommended to every grade of metallurgist, as the authors had the best of facilities for securing data. The section on aircraft drop forgings by Dr. Aitchison is of particular interest for foundrymen, as it cannot help but impress upon them the inroads which this industry is capable of making on their production. We appeal to Sheffield or other University specialising in metallurgy to complete the subject by dealing similarly with the non-ferrous alloys used in aircraft construction, as they are of equal importance. As Mr. H. J. Rowledge puts it, "It is not too much to say that without aluminium pistons the present degree of engine efficiency could not have been attained." There is not much reference to cast iron, except to state "With cast iron we had reached the point where the piston was limiting further development." Apparently, all that is left to the iron foundry is the manufacture of piston rings. These are covered by Specification No. 2K6, which states that the carbon (presumably combined) is to be between 0.55 and 0.80 per cent.; the silicon, 1.8 per cent.; the manganese, between 0.60 and 1.20 per cent.; sulphur, 0.14 per cent.; and phosphorus, 1.0 per cent. The tensile must reach 14 tons per sq. in. The book runs into some 209 pages, and is well illustrated with 112 explanatory figures and illustrations. The book will form a useful addition to all foundry libraries.

Chart of Iron and Steel Prices.—Messrs. W. Richards & Sons, Limited, of Britannia Foundry, Middlesbrough, have recently published a Chart of Iron and Steel Prices, covering the period from January, 1914, to the present date; there are spaces left for filling in prices up to October, 1923. The chart is to be issued annually, about the beginning of October. A curve is included for the price of iron castings.

Smoke Abatement.

Criticism of the Fuel Research Board.

EX-BAILLIE W. B. SMITH, who was a member of the Departmental Committee on Smoke Abatement, as a result of the report of which the Smoke Abatement Bill was introduced in the last session of Parliament, read a Paper on this subject before the Royal Society of Arts on November 22. The general theme of the Paper may be said to be that, as the Government had taken such little interest in this problem, and, to all intents and purposes, had ignored the Report of the Departmental Committee, the time had come for dealing with the problem in other directions than by legislation alone. The author appealed to the public generally through the medium of statistics of increasing death-rates during periods of fog, and generally urged the greater use of gas and electricity in industries as well as for domestic purposes. He claimed that the Maclaurin process of low-temperature carbonisation had practically solved the problem of providing a cheap gas, and at the same time a good smokeless fuel, and suggested that the time had come when gas undertakings might now add a new department to their works, which in time would become quite as important and quite as remunerative as their present trade, namely, the supply of gas for heat and power to industries, and smokeless fuel for all purposes. A test made by the Glasgow Gas Department with the Maclaurin process had shown that gas for power purposes ought to be capable of being supplied at 1.2d. per therm, which could be conveyed through special mains, and that it was only by bringing down the price of gas to considerably under 3d. per therm that it would be possible for gas to displace coal for steam raising.

In the course of a discussion, PROF. H. E. ARMSTRONG, F.R.S., said all the Committee had done was to prove there was a smoke nuisance. The thing was to find means for getting over the difficulty. The Committee had only dealt with the matter from the point of view of the gas interests, and had not dealt with it at all from the scientific side. He did not know what was behind the report of the Committee, but it paid a great deal of attention to the work of the Fuel Research Board. It seemed to him, however, that now was the time to inquire into what the Board had accomplished, what it had cost and what its programme had been; whether the programme was of any practical value, and whether it was desirable to continue the Board. The position at the moment was that we had no idea of what the programme of the Fuel Research Board was, or whether it was proceeding on scientific lines. He felt that such an inquiry into the position of the Fuel Research Board was necessary, because he had an idea that it was responsible for a great deal of the slowness of progress in this matter.

PROF. W. A. BONE remarked that the sooner a smokeless fuel could be manufactured and distributed at much the same price as coal the better. That was the direction in which the solution must be sought. He believed, however, that the problem of manufacturing a domestic smokeless fuel was one which did not merely include carbonising coal, and he looked forward to the time when the solid fuel for domestic use would be a much more highly manufactured article than anything that had yet appeared. He believed the time would come when the greater part of the ash would be removed by flotation processes, and that the coal would be carbonised in different ways to get particular textures to obtain a fuel of the requisite degree of combustibility, because the problem was not simply one of smokelessness, but of obtaining a fuel as ashless as possible also, together with the requisite degree of combustibility.

MR. JUSTICE P. O. LAWRENCE, on Tuesday, confirmed the resolutions of Vickers, Limited, extending their objects. The objects of the company were extended in 1918 to enable it to use in post-war trade the buildings and plant which it had acquired during the war for national purposes. As a result of these additional powers Vickers, Limited, are, it is pointed out, enabled to fully develop the great resources of the company

THE BECCO ENGINEERING & CHEMICAL COMPANY, LIMITED, have recently taken five orders for water softening and purifying plants, including the Gas Light & Coke Company, the Bush Company, Limited, Thos. Whiffen & Sons, Limited, and the Erith Oil Works, Limited. At the latter works, the company are installing a water softening plant of 16,000 gallons per hour capacity, and a heater of 20,000 per hour capacity.

Rubber Equipment in the Foundry.*

Leakage, waste of power and higher operating cost may be traced directly to the use of unsuitable hose and other forms of rubber equipment. The subject may be considered under the following heads:—Hose for vibrators, pneumatic tools, air hoists, sandblast, sandblast barrels, for wetting down the sand, for paint spraying machines, and for acetylene and oxygen. Additionally there are rubber gaskets for sandblast barrels, rubber cloth inserted sheets for lining sandblast chambers, hose for pneumatic sand sifters, and hose for revolving steel brushes.

Compressed air is more costly than the power used to produce it, and therefore its efficient use deserves as much attention as that bestowed on steam, water or electric current. A leak in the air line, or excessive use at a motor will not endanger the operator. In this respect it differs from steam which clouds the view, electric current sometimes responsible for a shock or burn and water which floods the premises. Nevertheless, to save the coal pile, careless and wasteful methods of handling compressed air should be eliminated. To do this several basic features should be kept in mind. Leakage at couplings, or through the hose never should be permitted to exist. They can be prevented by the proper application of gaskets in connection with the couplings and by exercising care in the selection of the hose itself.

Pressure which the hose will stand is inversely proportional to its diameter. A 1-in. 6-ply hose may have a bursting pressure as high as 800 lbs., while a 2-in., 6-ply hose made of the same materials would burst at 650 lbs. Hence care always should be taken to specify greater number of plies for the larger sizes.

Kinking.

To secure good, economical service, air hose must not kink. Kinking not only shuts off the supply of air at the time, but it creates a permanent injury in the wall of the hose, which later develops into a leak. To prevent accidents of this character, the thickness and number of plies must be proportioned to the size of the hose; the rubber must be of good quality and the inner tube, fabric and outer cover must be properly proportioned to each other.

Sometimes customers specify wire winding as a protection against outside wear. The practice is not recommended. It makes the hose heavy and hard to handle. Once bent, the hose is hard to reshape, and a wire covering is more costly than the thick rubber cover recommended as the best protection for the outside of the hose.

A moulded hose is advisable for any length over 50 ft. This type of hose eliminates extra couplings which retard the flow of air and decreases the pressure at the tool. This is an important feature. It has been found that a 15-lb. increase in pressure can make a 37 per cent. difference in the amount of work accomplished by the tool.

Vibrator Hose.

Air hose used in connection with vibrators on moulding machine usually is $\frac{5}{16}$ to $\frac{3}{8}$-in., and should be of the best quality with a good resilient oil proof tube. It also should have a cover of resilient rubber and the walls should be heavy and substantial. This hose is not subjected to external abrasion, but the cover and wall must be heavy enough to absorb the continued bending without kinking or cracking. The outside sometimes is chafed off by scraping the hose over machines.

Pneumatic Tool Hose.

Hose for chipping and other pneumatic tools, also should be the best procurable. It is subjected to the hardest use, dragged over rough castings, run over by trucks and abused in general. The cover should consist of about a $\frac{1}{16}$-in. thickness of tough rubber. Until recently the practice was to use a $\frac{3}{4}$-in. hose wire wound for the line, with a short length of $\frac{1}{2}$-in. hose, not wire wound, on the end and termed the leader. At present the practice almost exclusively is to use a $\frac{1}{2}$-in. hose without wire winding. A good rubber cover will withstand more abrasion than wire. Wire makes the hose heavier and in addition it becomes flattened when a casting drops on it or a truck passes over it, making it necessary to hammer out the kinks. The automobile tyre furnishes a good illustration of this feature. The tread certainly gets its share of abrasion. Tough rubber has been found the best protection against this abrasion. Metal studded tyres have not proved successful. The character of the tube, or lining, of hose used for this purpose is a most important feature. It should be oil proof, high grade and firmly anchored or vulcanised to the fabric. Oil proofing tends to prevent the ends from becoming soggy and soft through the action of the oil and, what is more important, it prevents decomposition of the tube throughout the entire length of the hose. Oil will affect a poor tube seriously and then small particles of rubber become loosened and are carried to the tool preventing proper functioning of the air ports.

Testing New Hose.

In large foundries many feet of air hose are under pressure at one time. Leaks in the hose mean loss of coal and power. It also means a slower functioning of the tools. Leakage may be divided into three classes: leakage of new hose, leakage of hose which has been in service from three to six months and leakage of old or broken hose. The latter is most easily detected and may be remedied at once, but the other two conditions are apt to create more trouble. After a series of exhaustive tests a prominent mining journal concluded that even new hose leaks, although so slightly that the leaks cannot be detected in the usual manner. It was found that new hose which enlarges most in diameter under pressure, leaks most. Therefore it is advisable to instal hose so constructed that the pressure will elongate it but not increase the diameter. This feature is governed on braided or woven hose by the angle of the threads in the braiding.

Hose three to six months old requires the closest watching. Particular attention should be directed to hose apparently in good shape and presenting no cuts or warning breaks. Time after time hose in this condition has been tested by placing it under water and has been found to be full of little pin holes. This species of leak cannot be detected in any other manner. In a foundry where a few thousand feet of this kind of hose are under pressure, the conditions will be reflected definitely in the coal bill.

Air hose for hoists and other pneumatic tools would require the type of hose recommended in the foregoing. In some cases a somewhat cheaper hose might be used, but the practice is not recommended. The fact must be borne in mind that when a good hose and one of inferior quality are carried in stock, men are apt to apply the cheaper hose where the good one is needed. This practice may prove disastrous, but where all air hose is good hose no harm can be done by using it on all appliances and even on the easier jobs it will prove eventually economical.

Sandblast Hose.

One of the paradoxical points about sandblast service is that the softer the tube of the hose, the longer it will wear. The resilient rubber compound resists the abrasive action of the sand which wears away hard substances rapidly. The tube of the hose also must be smooth, because if there is the least roughness at any point, the wearing action will begin there. Flexibility also is important and the wall of the hose must be thick enough to prevent kinking, because the least kink in a sandblast hose means rapid destruction. For economy in this service, hose should be selected which has a thick inner tube of the best rubber and a good thick wall which is at the same time flexible and springy. Sandblast hose should be of a character that will hold the pressure and at the same time resist the abrasion of the sand. Until recently sandblast hose generally was furnished with a $\frac{1}{4}$-in. lining and with 4-ply duck. Later investigation has demonstrated that a 3-ply will hold the pressure in most instances where the hose is from 1 to $1\frac{1}{2}$-in.

* From an article by an anonymous writer in the "Brass World."

inside diameter. On a ¾-in. inside diameter 2-ply will do the work.

Plies in Sandblast Hose.

When the tube or lining is worn through, the plies of duck are useless in resisting the abrasion of the sand, they will give way at once. Therefore what was saved in cutting down the number of plies is utilised in providing a heavier and better lining. Good sandblast hose should have ¼-in. lining for practically all sizes and the plies should be as follows:—¾-in., 2-ply; 1-in., 3-ply; 1¼-in., 3-ply; 1½-in., 3-ply; and 2-in., 4-ply.

The tube is the heart of the hose. It should be pure gum, tough and resilient so that when the sand strikes it the lining will yield. The sand then will rebound. If the tube does not give, but resists the sand it will quickly be worn away just the same as the casting that is being sandblasted. It does not necessarily follow that all soft tubes are good. They are not. They must be soft, yet tough. A cheap rubber can produce a soft tube, but pure gum and zinc are necessary to produce a soft, tough tube. Wherever sandblast hose is subjected to a bend the wear will be most severe at that point, because the tendency of the blast is to go straight. This condition exists generally at the wall connection where the blast enters the hose. At this point the lining often is worn away completely on one side while still intact on the opposite side. The life of the hose may be extended by giving it a quarter turn every few days so that all sides of the lining will be subjected to the blast and thus wear uniformly.

Wetting Down Hose.

Hose employed for wetting down the sand and for other purposes around the foundry generally is used in ½ and ¾-in. sizes. A good garden hose will serve satisfactorily, as it is apt to get burned or damaged in some manner before it is worn out. Large castings made in many foundries are painted by a spraying machine. The paint hose practically is a good air hose but of somewhat lighter construction, which makes it easier to handle with a small paint gun. Both tube and cover should be of good rubber, oil proof and paint proof. This hose usually is used in ¼, 5-16 and ⅜-in. sizes.

Some manufacturers sell a hose with a black cover for connection with oxygen tanks and one with a red cover for the acetylene tank. This hose is a high-grade air hose, but lighter and more flexible for convenience in handling with small burners. The tube or lining should be of the best rubber, as it has a tendency to deteriorate, particularly from the effects of the acetylene. It is supplied in diameters from ¼ to ½-in.

Sandblast barrels require gaskets, square and round, of various sizes. The stock should be a good, medium, soft rubber. The gaskets vary from 1-16 to ¼-in. in thickness. They prevent the dust from coming out of the revolving barrels. The covers are removed frequently and therefore a high-grade rubber is recommended that will not harden quickly and fail to make a tight joint after the cover has been removed a few times.

Sandblast Chamber Linings.

The usual sandblast chamber is a small room enclosed in sheet metal. Castings are loaded on trucks and run into this chamber to be cleaned. During the operation part of the blast strikes the walls and eventually wears holes. To prevent this the walls are draped with rubber sheets about 3 ft. wide, 5 ft. long, and 1/16-in. thick. Originally this rubber sheet was not reinforced, and as a result the pieces tore long before they were worn out. In recent installations the rubber sheeting is reinforced with a single ply of fabric and probably will last indefinitely. The rubber should be of good quality and reinforced with light weight duck.

Special connections usually are furnished by the manufacturer of the machine for the paint hose and the oxygen hose. In all cases where couplings are applied at the plant, care should be exercised to see that these couplings are not forced into the hose and that there are no burrs on the end of the shank. If the shank couplings are treated with a little rubber cement they will go easily into the hose and stay there.

Trade with Japan.

A Report on the Commercial, Industrial, and Financial Situation in Japan, covering the period 1921 and up to June 30, 1922, by Sir E. T. F. Crowe, C.M.G. (Commercial Counsellor), and Mr. G. B. Sansom (Acting Commercial Secretary to the British Embassy in Tokyo), has been issued by the Department of Overseas Trade. It points out that from a British point of view the iron and steel business in Japan has been disappointing, as Great Britain is still a long way from recovering her pre-eminent position in that market and the American share is twice as great as hers; but our country has made some gains during the past few months, and in tinplates, for example, business has been better. The principal development during the period with which the report deals has been in black sheets. Very large quantities of these have been imported by the local galvanising works, but the business has been overdone, and the result is that many claims have been lodged on the ground that sheets were rusty. The galvanised sheets have been in great demand by house-owners who have to comply with the new regulations that houses within a certain distance of the railway line must have fireproof roofs.

German iron and steel has reappeared on the market, and as the quotations were extremely low a good deal of uneasiness was caused to competitors. Notwithstanding the various troubles which have occurred in connection with fishery concessions on the Siberian coast the fish canneries have absorbed large quantities of tinplate and this trade is sure to grow. The attempts to manufacture tinplate locally have not proved successful.

There has been no improvement in the position of the various Japanese ironworks, and at present prices it is said that they are unable to work at a profit. The following table gives an indication of the quantities of iron and steel imported:—

	1921.	1922 (Jan.-April).
	Tons.	Tons.
Iron ore	573,500	226,500
Pig-iron	225,300	75,200
Bars, angles, etc.	148,000	67,700
Plates and sheets	223,800	134,000
Galvanised sheets	16,000	8,000
Tinplates	43,000	29,000
Pipes and tubes	31,700	13,000
Galvanised wire	25,000	19,000
Wire nails	17,000	15,000
Rails	56,000	53,000
Scrap	9,000	15,000
Totals	1,368,300	655,400

Under the heading of machinery the most interesting item to be recorded is the placing by the Government railways of an order for 34 electric locomotives with a British firm. The contract was signed in June, 1922, and the delivery date is September, 1923, so that in next year's figures there will be a welcome increase in the British share.

The water-turbine machinery for Japan ordered during the year June, 1921, to June, 1922, amounts to about 400,000 b.h.p., of which 300,000 were ordered from abroad (two-fifths from America and three-fifths from Europe) and 100,000 from Japanese works. Over and above this there is the big Formosan plant for which machinery ordered comprises five units of 33,000 b.h.p. each. The amalgamation of hydro-electric companies is still going on, and it is mainly these large concerns which are now completing their extensive power schemes.

MR. W. H. COOK, a prominent member of the Institution of British Foundrymen, was the lecturer at last Saturday's meeting of the Manchester Association of Engineers, and dealt at some length with Pattern Plates before an appreciative audience. An excellent discussion followed the lecture, in which Messrs. Oliver Stubbs, Hindle, Key, Clayton, and Simkiss took part.

The New Parliament.

In our last issue we published a few biographical notes concerning some of the earliest members to be returned to the new Parliament. We are pleased to note that the foundry industries are represented on both sides of the House. We append further biographical details :—

BIRMINGHAM, DUDDESTON.—Sir Ernest Vaville HILEY, K.B.E., was Town Clerk of Birmingham and was lent to the National Service Department to be Director-General of National Service under the Rt. Hon. Neville Chamberlain. He afterwards resigned the Town Clerkship to become director and subsequently chairman of the Metropolitan Carriage Wagon & Finance Corporation, Limited, which includes in its subsidiaries the Patent Shaft & Axletree Company, Limited, and the Willingsworth Iron Company, Limited. When the Metropolitan concern amalgamated with Vickers, Limited, he joined the latter board, but has now resigned these directorships.

BIRMINGHAM, YARDLEY.—Mr. A. R. Jephcott, a well-known Birmingham engineer.

BLACKBURN.—Sir Sydney H. H. Henn, a director of the Horsley Bridge & Engineering Company, Limited.

BOOTLE.—Major J. Burnie, a director of Bell & Burnie, Limited.

CHELSEA.—Lt.-Col. Sir Samuel J. G. Hoare, Bart., C.M.G., is a director of the Birmingham Aluminium Casting (1903) Company, Limited, and deputy-chairman of the Employers' Liability Assurance Corporation, Limited.

CHESTER, ALTRINCHAM.—Major Sir Collingwood G. C. Hamilton, was Controller of Enrolment for National Service in 1916, and Controller of Contract Claims under the Ministry of Munitions in 1918. Later he acted as private secretary to the Secretary of State for War. He is chairman of the Expanded Metal Company, Limited.

CORNWALL, NORTHERN.—Sir George Croydon Marks, C.B.E., is a consulting engineer and patent expert, and has written several text-books on engineering and allied subjects. He is a partner in the firm of Marks & Clerk, consulting engineers and patent agents.

COVENTRY.—Mr. Edward Manville, M.Inst.C.E., is chairman of the Daimler Motor Company, Limited, and deputy-chairman of the Birmingham Small Arms Company, Limited. He is an ex-president of the Association of Chambers of Commerce of the United Kingdom, and a vice-president of the Federation British Industries.

ECCLESALL.—Sir Samuel Roberts, D.L., is the head of an old Sheffield family, and was Lord Mayor of the city in 1899-1900. He has represented the Ecclesall Division since 1902; he received a knighthood in 1917 and a baronetcy in 1919. At the dissolution he was further made a Privy Councillor. He is a director of Cammell, Laird & Company, Limited, and J. Grayson Lowood & Company, Limited, and chairman of Wright, Bindley & Gell, Limited.

FULHAM, EAST.—Lt.-Col. K. P. Vaughan-Morgan, director and vice-chairman of the Morgan Crucible Company, Limited, of Battersea.

GATESHEAD.—Mr. J. Brotherton (Lab.) is an engineer by trade, and has been a prominent figure for several years in connection with industrial matters affecting the engineers.

GLASGOW, CENTRAL.—Mr. A. Bonar Law is the first Premier to sit for Glasgow. He was educated at Glasgow High School, and it was in the city that he founded his reputation as a business man with the firm of Messrs. Wm. Kidston & Sons, and Messrs. Wm. Jacks & Company, both iron merchants.

GLASGOW, HILLHEAD.—Sir Robert Horne has a notable record of public service, but is best known as Chancellor of the Exchequer in the late Government. He is vice-chairman of Baldwins, Limited.

HACKNEY, CENTRAL.—Col. Sir Arthur Levy Lever, Bart., is chairman of the Eyre Smelting Company, Limited, and a life director of Hart & Levy, Limited.

ISLINGTON, NORTH.—Maj.-Gen. the Hon. Sir Newton James Moore, K.C.M.G., is a director of the Dominion Steel Company, Limited, and the General Electric Company, Limited.

LANCASHIRE, MOSSLEY.—Mr. Austin Hopkinson is the proprietor of the Delta Engineering Works, Guidebridge, near Manchester.

LEEDS, NORTH.—Mr. H. M. Butler is a director and secretary of the Kirkstall Forge, Limited, Kirkstall Forge, near Leeds.

PONTYPOOL.—Mr. T. Griffiths (Lab.), who has represented the division since 1918, was appointed organiser of the British Steel Smelters' Association in 1899, and divisional officer of the Iron and Steel Trades Confederation in 1906.

SMETHWICK.—Mr. J. E. Davison (Lab.) is an official of the Ironfounders' Society.

Trade Talk.

THE GATH ELECTRIC ENGINEERING COMPANY, of Halifax, are removing their showrooms from Southgate to Horton Street.

YORKSHIRE ENGINE COMPANY, LIMITED, Meadow Hall Works, Sheffield, have changed their London offices to 15, Caxton House, Westminster, S.W.1.

THE READ ENGINEERING COMPANY (LONDON), LIMITED, have removed their registered offices from 17, Finsbury Street, to 78, Coleman Street, London, E.C.2, and will in future utilise their old premises for warehouse purposes.

G. D. PETERS & COMPANY, LIMITED, and their subsidiary companies—the Consolidated Brake & Engineering Company, Limited, and the British Air Brake Company, Limited—have removed to Caxton House, Tothill Street, Westminster, S.W.1.

AS A SETTLEMENT with the Inland Revenue authorities upon excess profits duty and munitions levy has not yet been reached, the annual accounts of Palmers Shipbuilding & Iron Company, Limited, could not be presented at their late meeting.

THE ANNUAL DINNER of the Industrial League and Council, postponed owing to the General Election, will be held on December 6. The chief guests will be Sir W. J. Noble, Bt., and Mr. J. B. Williams, the new chairman of the Trade Union Congress. Lord Burnham is to preside.

THE MEMBERS of the Institution of Engineers and Shipbuilders in Scotland met in the Rankine Hall, Glasgow, last week, when a paper entitled "The Treatment of Mild Steel" was read by Dr. Walter Rosenhain, and another on "Launching Velocities and Drags," by Professor Percy A. Hillhouse.

DR. BENGOUGH, the investigator to the Corrosion Research Committee in connection with the Institute of Metals, was present at a meeting of the Sheffield Society of Engineers and Metallurgists, recently, and read a paper entitled "The Function of Colloids in Metallic Corrosion." Mr. T. W. Willis presided.

AT A MEETING of the North-East Coast Institution of Engineers and Shipbuilders (graduate section), in the Neville Hall, Newcastle, Mr. J. C. Arthur presiding, a paper was read by Mr. L. S. Swinnerton-Dyer (of Sir W. G. Armstrong, Whitworth & Company), on "The Limit of Power of Diesel Engine Cylinders."

MR. A. T. THORNE and Mr. J. Calderwood, both members of the firm of Swan, Hunter & Wigham-Richardson, Limited, submitted a paper on "Torsional Oscillations with special reference to Marine Reduction Gearing," to the North-East Coast Institution of Engineers and Shipbuilders at Newcastle on October 17.

LICENCES under the Non-Ferrous Metal Industry Act, 1918, have been granted to R. M. Bennett, 72, Old Hall Street, Liverpool; Dowdeswell & Morgan, 37 and 38, Merchants' Exchange, Bute Docks, Cardiff; Pickett Metal Corporation Société Anonyme, 22, Queen Anne's Gate, London, S.W.1; South-West Africa Company, Limited, 1, London Wall Buildings, London, E.C.2.

THE BURNTISLAND SHIPBUILDING COMPANY, LIMITED, have secured an order for the building of a steamer for Bristol Channel owners and for the construction of two smaller craft of 1,000 tons each, also to the order of British owners. The Caledonian Shipbuilding & Engineering Company, Limited, have received an order to build two steamers, each of about 6,000 tons, for the Holt Line, Liverpool.

THE contracts for the electrification of a section of the Natal railway, involving a total expenditure of nearly £4,500,000, have been secured by the Metropolitan-Vickers Electrical Company, Limited, C. A. Parsons & Company, Limited, Babcock & Wilcox, Limited, British Thomson-Houston Company, Limited, Telegraph Manufacturing Company, and R. Reyrolle & Company, Limited.

THE SECOND DIVISION of the Edinburgh Court of Session have granted the petition of the Ardrossan Dry Dock and Shipbuilding Company, Limited, incorporated in 1899, and approved of the special resolution of the company by which the share capital of £720,000 (originally only £20,000) was recently reorganised so as to consist of preferred ordinary and deferred ordinary shares, in place of the participating preference, cumulative preference, and ordinary shares.

AT A MEETING of the North-Western Centre of the Institution of Electrical Engineers, held on November 14, at Manchester, Mr. A. S. Barnard, chairman, delivered his inaugural address. He said the members were concerned with many things, the electrical equipment of ships and railways, the use of electricity in surgery and therapeutics, in agriculture and mining, and in the textile and chemical industries. He hoped that during the session some attention would be given to the important work of electrical engineers in collieries.

IRON AND STEEL MARKETS.

Pig-iron.

With the notable exception of Scotland, all the principal centres of the pig-iron industry evidence signs of returning confidence, largely due, doubtless, to the result of the recent elections indicating the restoration of more stable political conditions in the country, which should go far to establish a revival of trade and solve the urgent problem of unemployment and its evils. The exception quoted above, that of Scottish smelters, may unquestionably be attributed to the cessation in American buying of late, although last week an inquiry was current on the Glasgow market for 10,000 tons of pig for that destination. Unfortunately, export business on this scale has not materialised, buying being again confined to small parcels for prompt delivery, consumers being evidently content for the time being to limit their transactions to hand-to-mouth parcels. In the Midland area, pig-iron business is reported as slowly improving, the heavy-iron founders having some fairly good orders on hand, while the engineering branches are also getting more active. This has given a slight impetus to the demand for foundry iron, with a corresponding improvement in inquiries for forge qualities. Quotations in the South Staffordshire market are consequently steady, but not quite so firm as would appear on the surface, competition being exceptionally keen for any business offering. Better reports are also to hand from Lancashire, where the market for foundry iron is certainly not so restricted, a larger tonnage of No. 3 quality now being delivered in the district. The anticipation of a rise in the price of Derbyshire iron is not now so strong as it was, and it seems probable that makers will be content to continue selling at 82s. 6d. on trucks for No. 3. The price does not leave much profit on the iron, but probably there is a fair return on the whole working of the furnaces when the by-products are taken into consideration. Business in the Cleveland iron market is, at present, quiet, with prices showing an easier tendency, due possibly to the termination of American buying on a large scale, and a decline in export demand generally. There is, however, still an active market for foundry iron for prompt shipment, but makers are already fully sold till next March, and buyers are too cautious to commit themselves further forward, there being a feeling on the other side that American prices will come down. Ordinary Cleveland iron is too high in phosphorus for American users, but if price comparisons continue to be favourable some further sales will probably be made. In the meantime, while it is possible in some cases to shade Cleveland quotations up to 6d. per ton, makers show no disposition to make any further concessions except in the case of No. 4 foundry, which was offered last week at as low as 87s. 6d. Subject to the concessions just mentioned, last week's quotations are maintained as follows:—No. 1 and silicious, 97s. 6d.; No. 3 G.M.B., 92s. 6d.; No. 4 foundry, 87s. 6d.; and No. 4 forge, 85s.

Hematite is a strong market. Demand continues to improve, and another furnace is about to be put in on Tees-side. The better outlook in the local shipbuilding industry should certainly tend to strengthen matters further. The position at the different works varies somewhat, and prices are a little irregular. For East Coast mixed numbers 93s. is a general quotation, but 93s. 6d. is also named, and 94s. is stated to have been actually paid. No. 1 is at a premium of 6d. to 1s. per ton.

Finished Iron.

Business in this department of the iron trade, although slightly improved in volume, continues quiet, conditions which must be anticipated as likely to remain over the concluding month of the current year. In South Staffordshire movements in the market are again chiefly confined to the bar-iron section, in which inferior qualities of material are subjected to considerable foreign competition, Belgium especially being favoured at the moment by the rate of exchange. Quotations of £7 10s. delivered for this imported material are still mentioned, and British-made nut and bolt iron is reported to have been sold down to £9 10s. in consequence. This latter price is not general, however. Some British makers are off the market at less than £9 15s. There is little change in connection with better quality bars, crown and marked, although recent experience of the volume of demand encourages the hope that an improvement has begun. There is nothing more hopeful in connection with gas strip. It will not sell freely at the price now quoted.

Steel.

Continued improvement can at last be reported in the steel trade position, and is also reflected in a similar way in most of the auxiliary industries. Reports to hand indicates more steel furnaces going into operation, several of the leading firms having recently booked substantial orders in departments that have been idle for months past. Already a substantial tonnage of new orders is being received by the shipyards, among them two Tees yards, one of which, Richardson Duck's, will be kept busy for a year. A new large passenger and cargo steamer for the Ellerman line has been placed with a Hull yard, and a new 20,000-ton steamship for the Orient Steam Navigation Company with John Brown & Company, of Clydebank. The manager of one of the principal manufacturing firms in Sheffield stated recently that substantial orders for locomotives, wagons, carriages and railway materials are now being placed in this country, and some still larger orders are coming forward. This report is further confirmed by a steady buying of ferro-silicon and manganese alloys, which, though at present in moderate quantities, is distinctly on an increasing scale. In the market for semi-products, basic material, which has been improving for some time past, is very active, and a big tonnage is now being produced. Acid steel billets are distinctly reviving after a long period of quietude; in fact, in all classes of steel except high-speed there is a decided improvement. Some additional open-hearth furnaces are being put into operation, and a number of crucible furnaces are now running five days a week. Unfortunately there is rather grave price cutting going on, which makes a proportion of the business in hand absolutely unremunerative. Some improvement has to be noted in the tinplate industry. The fixed minimum is being adhered to, and 3d. more per box is now generally asked, making the current price 19s. 9d. for the standard box. There are one or two makers, however, who are not so well placed, having substantial specifications against speculative purchases to come in, who are offering plates at the 19s. 6d. minimum. Most makers, however, are well booked up for a couple of months, and are receiving specifications fairly freely.

Scrap.

The improvement in demand for heavy steel scrap continues undiminished, and in Scotland is now being quoted at 72s. 6d., although it is stated that more has been paid. Sellers are, as a rule, showing no inclination to commit themselves for delivery ahead at this price, as even now they are finding it impossible to purchase other than odd wagon loads on anything like the foregoing basis. On Clydeside, also, the iron works are now finding difficulty in securing supplies of wrought-iron scrap even for their limited requirements. Holders' stocks have been gradually dwindling down, and unless in the case of a certain class of dismantling job it is practically impossible to get any appreciable quantity of piling scrap. At Middlesbrough business in scrap has been very quiet during the past week. The demand for heavy steel, however, is still quite active for suitable specifications, and the price is unchanged at 68s. per ton delivered works. Other delivered quotations are:—Steel turnings, about 54s.; cast-iron borings, 52s. 6d.; heavy cast-iron machinery scrap in handy pieces, 75s. to 77s. 6d.; heavy wrought-iron bushelling scrap, 55s. to 57s. 6d.; ordinary heavy piling, 60s.; specially selected heavy forge, 70s. to 75s. per ton.

Metals.

Copper.—Conditions in the standard copper market of late have indicated a tendency to lower values, and the fluctuations recorded have been mostly in that direction. Consumptive demand is, however, fairly steady, but buying on home and Continental account continues slow, conditions which may be expected to continue over the remainder of the year. Based on the expectation that copper would to some extent follow the rise in other metals, a certain amount of speculative activity in this market was recently in evidence, but the anticipated rise did not mature. This is mainly due to the fact that the copper market is not affected by such a large number of factors as those that influence tin, lead and spelter. Current quotations:—*Cash*: Wednesday, £62 12s. 6d.; Thursday, £62; Friday, £61 12s. 6d.; Monday, £61 15s.; Tuesday, £61 10s. *Three Months*: Wednesday, £63 12s. 6d.; Thursday, £63; Friday, £62 12s. 6d.; Monday, £62 12s. 6d.; Tuesday, £62 7s. 6d.

Continued on page 456.

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IRON AND STEEL MARKETS,—*Continued.*

Tin.—Following a period of somewhat exceptional activity, the market for standard tin has developed an irregular tendency in values, although fluctuations are still confined within comparatively narrow limits. Some fairly heavy realisations have been effected, and "bears" have seized this opportunity to cover freely, from which it would appear that the technical position of the market has been considerably modified. Sales reported in the East have been on a smaller scale, but at the same time demand on the part of consumers has been somewhat attenuated, the reactionary tendency of the market no doubt restricting purchases. The stocks of tin held in the Federated Malay States are again brought to notice by an official communication from the F.M.S. Government authorities to the effect that the stocks of tin in the hands of the parties to the Bandoeng Conference will not be released until it appears desirable to sell. When tin reaches a certain price, which is not stated, small quantities will be released weekly. If the price falls off again below the point fixed no further tin will be released until prices revive. Current quotations:—*Cash*: Wednesday, £177 10s.; Thursday, £174 10s.; Friday, £174 10s.; Monday, £174 15s.; Tuesday, £174 12s. 6d. *Three months*: Wednesday, £178 5s.; Thursday, £175 15s.; Friday, £175 12s. 6d.; Monday, £175 15s.; Tuesday, £175 12s. 6d.

Spelter.—A lower tendency in prices has been marked of late in spelter values, and the recent inflated levels appear to have reacted to a rather substantial extent. The market is still reported firm on the Continent, particularly in Germany. The present high price and the possibility of further supplies being forthcoming from America as a consequence of developing output, together with the tendency for sterling exchange on New York to improve, have been undoubtedly the chief factors in preventing any further appreciable advance. Current quotations:—*Ordinary*: Wednesday, £37 5s.; Thursday, £36; Friday, £36 5s.; Monday, £37; Tuesday, £38 10s.

Lead.—The market for soft foreign pig has been quiet during the current week, the recent buying movement having apparently eased off for the time being. So far, however, the general position is practically unchanged, but the consumptive demand has decreased, and it is considered unlikely that values will be affected to any appreciable extent. Current quotations:—*Soft foreign (prompt)*: Wednesday, £26 12s. 6d.; Thursday, £26 10s.; Friday, £26 10s.; Monday, £26 10s.; Tuesday, £26 10s.

Gazette.

THE "WATT" ELECTRICAL COMPANY, LIMITED, are being wound up voluntarily.

A WINDING-UP order has been made against the British Metal Pressings (1921), Limited, Nile Street, Birmingham.

MR. G. SAUNDERS (trading as Robt. Saunders), Bay House, Pattingham, and Doctor's Piece, Willenhall, lock manufacturer and brass founder, has been adjudicated bankrupt.

MR. H. MERRYLEES, late Sutton Lodge, Great Sutton, near Chester, now The Limes, Marks Tey, engineer, has been adjudicated bankrupt. Exam., C.C., Birkenhead, January 31, at 11.

MESSRS. J. MILLS AND C. MILLS, engineers and machine tool makers, Old Farm Works, 34, Angelina Street, Birmingham, trading under the style of J. & C. Mills, have dissolved partnership. Mr. J. Mills continues.

THE PARTNERSHIP heretofore subsisting between Messrs. C. H. Walters and F. W. Brownsmith, metal merchants, 14, New Street, Birmingham, trading under the style of Fredk. Brownsmith & Company, has been dissolved.

TRADING under the style of Austin Cousins & Company (Messrs. R. W. Cousins and F. C. Austin), Castle Buildings, Swansea, engineers, merchants and commission agents, have dissolved partnership. September 30. Debts by Mr. F. C. Austin.

TRADING under the style of the West Don Steel Company (Messrs. T. H. Denton, H. Gee, and W. R. Worrall), West Don Street, Sheffield, steel manufacturers and merchants, have dissolved partnership. November 9. Debts by Messrs. H. Gee and W. R. Worrall, who continue the business.

MESSRS. W. H. B. TROMAN AND H. L. TOOTH, formerly trading as W. H. B. Troman & Company, 34, Rooth Street, Wednesbury, metal merchants. Mr. Troman subsequently trading in the name of the firm and Mr. Tooth in the name of H. & S. Lee & Company, have been adjudicated bankrupts.

A MEETING OF THE UNSECURED CREDITORS of Thomas and Isaac Bradley, Limited, Capponfield Blast Furnaces, Bilston, in voluntary liquidation, has been convened for the purpose of voting upon the scheme, the terms of which were approved by the members of the committee appointed by the creditors at the meeting held on June 7.

Company News.

Siemens Brothers & Company, Limited.—Interim dividend on ordinary shares passed.

Blyth Shipbuilding & Dry Docks Company, Limited.—Final dividend, 9d. per share, less tax.

Warbrooke Engineering Company, Limited, 139, Cannon Street, London, E.C.—Capital £50,000 in £1 shares. Directors: W. G. Wark, G. Brooke and A. Howarth.

Dorman, Long & Company, Limited.—Dividend on preferred ordinary, 8 per cent. per annum, less tax, for half-year ended September 30; no dividend on ordinary shares.

The Broomside Foundry Company (1922), Limited, Broomside Foundry, Camp Road, Motherwell.—Capital £7,000 in £1 shares. Directors: S. Anderson and A. Auld.

William Buckley & Company (Millsands), Limited.—Capital £10,000 in £1 shares. Engineers. Directors: H. W. D. Fielding, Harriet Pagan, J. A. Pagan, and G. S. Rich.

Langdon Engineering Works, Limited, Bond Street, Northam, Southampton.—Capital £15,000 in £1 shares, to take over the business carried on by A. G. Langdon, as the Langdon Engineering Works.

Charles Bell, Limited, the Iron Works, Bath Street, Leeds Road, Bradford.—Capital £15,000 in £1 shares (7,500 5 per cent. cumulative preference and 7,500 ordinary). Engineers. Directors: Lazarus Bell, Leonard Bell, and H. H. Cassé.

Cargo Fleet Iron Company, Limited.—Report for 1921:—Profits, £138,562; brought forward, £130,635; depreciation, £25,000; debenture interest, £41,351; available, £202,845; dividend, 5 per cent., less tax, £50,000; carry forward, £152,845.

South Durham Steel & Iron Company, Limited.—Accounts for 1921: Profit, £88,566; brought forward, £122,846; debenture interest, £13,500; depreciation, £30,000; dividend, 2s. per share for year, £35,000; carried forward, £114,912. Report for 1922: Profit, £99,651; brought forward, £114,912; total, £214,562; depreciation, £30,000; dividend, 2s. per share for year; carried forward, £118,062.

Romford Engineering Company, Limited, 108, Victoria Street, London, S.W.1.—Capital £5,500 in 5,000 12½ per cent. participating preference shares of £1 each and 10,000 founders' shares of 1s. each, to adopt an agreement with Axioms, Limited, and to carry on the business of manufacturing engineers, etc. Directors: W. Wrentmore, C. E. Ralfs and Engineer-Commander T. H. Greenwood.

Deaths.

MR. W. WRIGHT, a director of the Burnbank Foundry Company, Limited, of Falkirk, died on November 5, aged 59.

MR. A. J. HORSEY, managing director of the Iron and Marble Company, Limited, 33, Victoria Street, and Thomas Street, Bristol, died recently, aged 69 years.

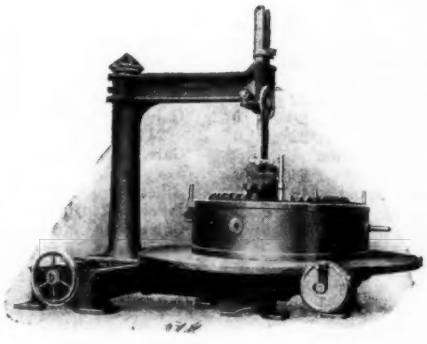
MR. D. F. MCNAUGHTON, managing director of Glegg & Thomson, Limited, iron and metal merchants, of 255, George Street, Aberdeen, died on November 2.

MR. J. H. BROOMHEAD, iron, steel and metal merchant, of Norton Street, Ancoats, Manchester, died recently. The business will in future be carried on by his son, Mr. W. C. Broomhead.

COLONEL GEORGE KEARSLEY died on November 7, at his residence, Prospect House, Ripon, in his 81st year. The deceased gentleman was for many years a partner in the British Ironworks, which business is now carried on by Kearsley & Company (Engineers), Limited.

PROVOST FROOD, J.P., managing director of the Motherwell Iron & Steel Company, Limited, Motherwell, died on October 27. The deceased gentleman was in 1920 elected first Provost of the amalgamated Burgh of Motherwell and Wishaw, and took an active part in municipal work.

MR. C. V. FAVIELL, chairman of John Stewart & Son (1912), Limited, died recently at Teddington. Mr. Faviell, who was the youngest son of the late Mr. W. F. Faviell, of Down Place, near Guildford, was born in Ceylon in 1865, and early in his career took part in the construction of the Manchester Ship Canal. In May, 1891, he joined the firm of John Stewart & Son, Limited, of the Blackwall Iron Works and Canal Dry Docks, Poplar, as a director, being associated in the management of the company for many years with the late Mr. Joseph C. Jobling. He continued as a director until John Stewart & Son (1912), Limited, was formed, when he was elected chairman.



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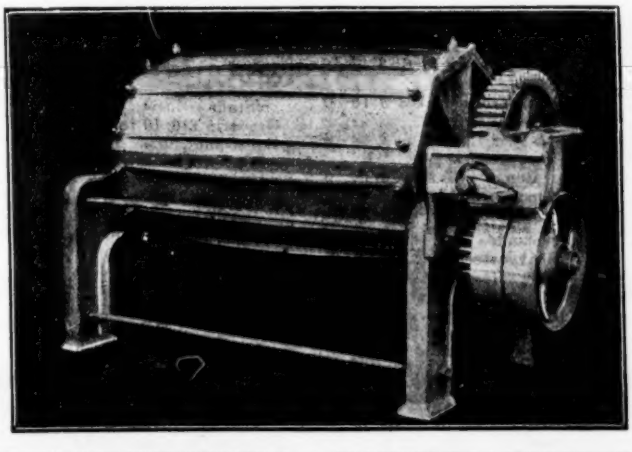

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COPPER.

	£	s.	d.
Standard cash	61	10	0
Three months	62	7	6
Electrolytic	69	5	0
Tough	61	15	0
Best selected	64	15	0
Sheets	96	0	0
India	84	0	0
Wire bars	69	10	0
Do. Dec.	69	10	0
Do. Jan.	69	10	0
Ingot bars	69	10	0
H.C. wire rods	74	0	0
Off. aver. cash, Oct.	62	16	5 3/32
Do. 3 mths., Oct.	63	8	11 5/32
Do. Settlement Oct.	62	15	10 15/32
Do. Electro, Oct.	71	0	0
Do. B.S., Oct.	66	11	1 1/2
Aver. spot price, copper, Oct.	62	15	4 3/4
Do. Electro, Oct.	71	5	11
Solid drawn tubes			13½d.
Brazed tubes			13½d.
Wire			10½d.
Yellow metal rods			6½d.
Do. 4x4 Square			8½d.
Do. 4x3 Sheets			9½d.

BRASS.

Solid drawn tubes	11½d.
Brazed tubes	13½d.
Rods, drawn	10½d.
Rods, extruded or rolled	6½d.
Sheets to 10 w.g.	10d.
Wire	9½d.
Rolled metal	9½d.

TIN.

	£	s.	d.
Standard cash	174	12	6
Three Months	175	12	6
English	174	12	6
Bars	176	15	0
Chinese	173	10	0
Straits	176	10	0
Australian	175	15	0
Eastern	178	5	0
Banca	175	10	0
Off. aver. cash, Oct.	170	12	4 7/11
Do. 3 mths. Oct.	171	11	4 8/11
Do. Sttlment. Oct.	170	12	0 6/11
Aver. spot, Oct.	170	11	3

SPELTER.

	£	s.	d.
Ordinary	38	10	0
Remelted	33	0	0
Hard	27	0	0
Electro 99.9	40	10	0
English	37	5	0
India	28	0	0
Prime Western	38	5	0
Zinc dust	49	0	0
Zinc ashes	11	0	0
Off. aver., Oct.	34	0	6 3/22
Aver., spot, Oct.	34	11	4½

LEAD.

	£	s.	d.
Soft foreign ppt	26	10	0
English	27	10	0
Off. average, Oct.	25	1	3
Average spot, Oct.	25	11	3

ZINC SHEETS.

	£	s.	d.
Zinc sheets, English	41	10	0
Do. V.M. ex. whf.	42	0	0
Dutch	42	0	0
Rods	49	0	0
Boiler plates	40	10	0
Battery plates	42	10	0

ANTIMONY.

	£	s.	d.
English regulus	27	0	0
Special brands	33	10	0
Chinese	25	5	0
Crude	17	10	0

QUICKSILVER.

	£	s.	d.
Quicksilver	12	0	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
45/50%	11	10	0
75%	19	10	0
Ferro-vanadium— 35/40%	17/- lb. va.		
Ferro-molybdenum— 70/75% c. free	9/6 lb. mo.		
Ferro-titanium— 23/25%, carbonless	1/2 lb.		
Ferro phosphorus, 20/23%	£24		
Ferro-tungsten— 80/85%, carbon free	1/5 lb.		
Tungsten metal powder— 98/99%	1/11 lb.		
Ferro-chrome— 4/6% car.	£23	10	
6/8% car.	£22	10	
8/10% car	£21	10	
Ferro-chrome— Max. 2% car.	£54	0	
Max. 1% car.	£65	0	
Max. 0.70% car.	£72	10	
67/70%, carbonless	1/7 lb.		
Nickel—99%, cubes or pellets	£137	10	
Cobalt metal—98/99%	11/6 lb.		
Aluminium—98/99%	£100		
Metallic Chromium— 96/98%	5 - lb.		
Ferro-manganese (net)— 76/80%, loose	£15		
76/80%, packed	£16		
76/80%, export	£14	10	
Metallic manganese— 94/96%, carbonless	2/3 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. to 8 in. inclusive	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d lb.
Flats under 1 in. by ¾ in. to ¼ in. by ½ in. and all sizes over four times in width over thickness	3d. lb.
Bevels of approved sizes and sections	6d. lb.
If in coils	3d. lb.
Packing	£3 ton.
Bars cut to length	10% extra

Scrap from high-speed tool steel—

Scrap pieces	3d.
Turnings and swarf	1d

Per lb. net, d/d steel makers' works.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy Steel	3	13	6	3	17	6
Bundled steel & shearings	3	1	3	3	15	0
Mixed iron & steel	3	2	6	3	8	6
Heavy cast iron	3	10	0	3	12	6
Good machinery for foundries	3	15	0	4	5	0

Cleveland—	£	s.	d.
Heavy steel	3	8	0
Steel turnings	2	14	0
Cast-iron borings	2	12	6
Heavy forge	3	12	6
Bushelled scrap	2	16	3
Cast-iron scrap	3	15	0

Lancashire—	£	s.	d.
Cast iron scrap	3	15	0
Heavy wrought	3	2	6
Steel turnings	2	2	6

London—	£	s.	d.
Copper (clean)	57	0	0
Brass (clean)	32	0	0
Lead (less usual draft)	22	0	0
Tea lead	20	0	0
Zinc	22	0	0
New aluminium cuttings	64	0	0
Braziery copper	48	0	0
Gun metal	44	0	0
Hollow pewter	130	0	0
Shaped black pewter	90	0	0

Above are merchant's buying prices delivered yard.

PIG-IRON.

N. E. Coast—	
Foundry No. 1	97 6
Foundry No. 3	92/6
Forge No. 4	85/-
Mottled	81/6
Hematite No. 1	93/9
Hematite M/Nos.	93/-
Midlands—	
Staffs. common	—
„ part-mine forge	—
„ „ foundry	—
„ Cold blast, ord.	190/-
„ „ roll iron	200/-
„ basic	—
Northants forge	70/- to 72/6
„ foundry No. 3	77/6 „ 80/-
„ basic	80/-
Derbyshire forge	75/-
„ foundry No. 3	82/6
„ basic	80/-
Scotland—	
Foundry No. 1	100/-
„ No. 3	95/-
Hematite M/Nos.	107/6
Sheffield (d/d district)—	
Derby forge	85/6
„ foundry No. 3	87/6
Lincs. forge	86/6
„ foundry No. 3	87/6
„ basic	86/6
E.C. hematite	104/2
W.C. hematite	110/-
All d/d in the district.	
Lancashire (d/d eq. Man.)	—
Derby forge	—
„ foundry No. 3	90/-
Northants foundry No. 3	—
Cleveland foundry No. 3	—
Staffs. foundry No. 3	—
Lincs. forge	—
„ foundry No. 3	—
Summerlee foundry	113 -
Glengarnock foundry	115 -
Gartsherrie foundry	115/-
Monkland foundry	113/-

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.
Bars (or.)	£10 10 to 11	10	0
Angles	£10 15 to 11	15	0
Tees to 3 united ins.	£11 to £12		
Nut and bolt	9	12	6
Hoops	14	0	0
Marked bars (Staffs.)	13	10	0
Gas strip	£10 10 to 10	15	0
Bolts and nuts, ¾ in. × 4 in.	17	10	0

Steel—	£	s.	d.
Ship plates	£9 to 9	10	0
Boiler plates	12	10	0
Chequer plates	10	5	0
Angles	£8 12 6 to 9	0	0
Tee	£9 12 6 to 10	0	0
Channels	8	10	0
Joists	9	0	0
Rounds & squares 3-in. to 5½in.	9	5	0
Rounds, under 3in. to ¼in.	8	15	0
Flats, over 5in. wide and up	9	10	0
Flats 5in. to 1¼in	8	15	0
Rails, heavy	8	15	0
Fishplates	14	10	0
Hoops	11	10	0
Black sheets, 24 g.	11	15	0
Galv. cor. sheets, 24 g.	17	7	6
Galv. fencing wire, 8 g. plain	16	0	0
Rivets, ½ in. dia	11	15	0
Billets, soft	6 0 0 to 7	0	0
Billets, hard	7 0 0 to 8	0	0
Sheet bar	6 15 0 to 7	7	6

PHOSPHOR BRONZE.

	Per lb basis
Strip	1 3
Sheet	1 3½
Wire	1 3½
Rods	1 2½
Tubes	1 6
Castings	1 1

Delivery 3 cwt. free to any town.

10% phosphor copper, £40 above price of B.S.

15% phosphor copper, £50 above price of B.S.

Phosphor tin (5%), £30 above price of English ingots.

Charles Clifford & Son Limited, Birmingham.

NICKEL SILVER, SHEET METAL, WIRE AND TUBES.

	Per lb.
Ingots for raising	11d. to 1/5
Rolled—	
To 9 in. wide	1/5 to 1/11
To 12 in. wide	1/5½ to 1/11½
To 15 in. wide	1/6 to 2/0
To 18 in. wide	1/6½ to 2/0½
To 21 in. wide	1/7½ to 2/1½
To 25 in. wide	1/8½ to 2/2½
Ingots for spoons and forks	11d. to 1/5
Ingots rolled to spoon size	1/2 to 1/8
Wire round—	
3/0 to 10. G.	1/8½ to 2/3½

with extras according to gauge

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	31.14
No. 2 foundry Valley	28.00
No. 2 foundry, Birm.	23.00
Basic	29.96
Bessemer	33.77
Malleable	30.96
Grey forge	29.77
Ferro-manganese 80 % delivered	100.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y, at mill	43.00
Bess. billets	38.00
O.-h. billets	38.00
O.-h. sheet bars	38.00
Wire rods	45.00
	Cents.
Iron bars, Phila.	2.32
Steel bars	2.00
Tank plates	2.00
Beams, etc.	2.00
Skelp, grooved steel	2.00
Skelp, sheared steel	2.00
Steel hoops	2.90
Sheets, black, No. 28	3.35
Sheets, galv., No. 28	4.50
Sheets, blue an'l'd, 9&10	2.60
Wire nails	2.70
Plain wire	2.45
Barbed wire, galv.	3.35
Tinplate, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	35/-
„ furnace	26/-
Durham & North. fdy.	27/6 to 30/-
„ furnace	22/6 to 25/6
Other Districts, foundry	25/- to 30/-
furnace	21/6 to 24 6

SWEDISH IRON.

Bars, hammered basis size. Basis price £22 to £23

	£ s. d.
Rolled Ordinary— Assortment ..	18 0 0
Nail Rods— Square, round and flats ..	to 18 10 0

Keg Steel nom. £38 to £40
Faggot Steel nom. £30 to £32

Blooms—
Single welded .. £10 to £11

Billets—
Single and double welded £13 to £14

Pig-Iron—
Grey, white or mottled .. £7 to £7 10 0

Prices are without engagement. All quotations are f.o.b. Gothenburg, net cash against documents there.

TUBES.

	Up to and incl. 6 in.	
Gas	57½%	Tube prices are now free.
Water	5 ½%	
Steam	47½%	

TINPLATES.

I.C.Cokes,	20×14, box		19/7½
,,	28×20,	,,	40/3
,,	20×10,	,,	28/4½
,,	18¾×14,	,,	20/3
I.X.		,,	46/-
I.X.X.		,,	52/-
F.C.B.Y.	21×13⅝	,,	36/6
C.V.B.G.	16¾×15,	,,	34 9
I.C.W.	20×14,	,,	17/10½
,,	28×20,	,,	35/6
,,	20×10,	,,	25/3
,,	18¾×14,	,,	18/4½
Ternepiates.	28×20,	,,	36 3

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
Nov. 22	62	12	6	dec.	5/-
,, 23	62	0	0	,,	12/6
,, 24	61	12	6	,,	7/6
,, 27	61	15	0	inc.	2/6
,, 28	61	10	0	dec.	5/-

Electrolytic Copper.

Nov. 22	70	10	0	No change	
,, 23	70	0	0	dec.	10/-
,, 24	69	10	0	,,	10/-
,, 27	69	5	0	,,	5/-
,, 28	69	5	0	No change	

Standard Tin (cash).

Nov. 22	177	10	0	dec.	10/-
,, 23	174	10	0	,,	60/-
,, 24	174	10	0	No change	
,, 27	174	15	0	inc.	5/-
,, 28	174	12	6	dec.	2/6

Tin (English ingots)

Nov. 22	177	10	0	dec.	10/-
,, 23	174	10	0	dec.	60/-
,, 24	174	10	0	No change	
,, 27	174	15	0	inc.	5/-
,, 28	174	12	6	dec.	2/6

Zinc Sheets (English)

Nov. 22	41	10	0	No change	
,, 23	41	10	0	,,	
,, 24	41	10	0	,,	
,, 27	41	10	0	,,	
,, 28	41	10	0	,,	

Spelter (ordinary)

Nov. 22	37	5	0	dec.	10/-
,, 23	36	0	0	,,	25/-
,, 24	35	5	0	inc.	5/-
,, 27	37	0	0	,,	15/-
,, 28	38	10	0	inc.	30/-

Lead (English)

Nov. 22	27	10	0	No change	
,, 23	27	10	0	,,	
,, 24	27	10	0	,,	
,, 27	27	10	0	,,	
,, 28	27	10	0	,,	

JOHN HALL & CO.,
OF STOURBRIDGE, LIMITED,
STOURBRIDGE, ENGLAND.

Manufacturers of
FIRE BRICKS, BLAST FURNACE BRICKS & CUPOLA BRICKS.

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Works:— Hadley, Shropshire.
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Telephone:— 11 Wellington, Salop. 5959 Central.

BARS, HOOPS, SECTIONS & WIRE
in IRON, STEED, COPPER and BRONZE.
Galvanised Telegraph, Telephone, Cable and Trolley Wire To all Specifications.
Contractors to H.M. Government (Admiralty, G.P.O., India Office, War Office, Colonies), English and Foreign Railways, &c.
BEST H. C. COPPER & BRONZE WIRE a speciality.
Medals:—Sydney (Bronze) 1879, New Zealand (Gold) 1882, Liverpool (Silver) 1886, Adelaide (Gold) 1887, Franco-British Grand Prix (Highest Award) 1908.

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SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.
IRON & STEEL SCRAP
COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,
ROYAL EXCHANGE, MIDDLESBROUGH.
93, HOPE STREET, GLASGOW.

SITUATIONS VACANT AND WANTED.

THE Lancashire Branch of the Institution of British Foundrymen beg to announce that several members, who have had varied experience as Foremen, etc., are at present disengaged. Employers who are in need of Foremen or other members of their foundry staff are invited to communicate with the Honorary Secretary, T. MAKEMSON, 21, Beresford Road, Stretford, Manchester

LATE PRODUCTION MANAGER of well-known firm desires position; experience in Engine and Ordnance Work, Colliery and General Engineering.—Apply, W. LAING, 4, Main Road, Handsworth, Sheffield.

WANTED.—FOREMAN PATTERNMAKER, experienced in heavy marine engine, general machine tools and special pipe patterns.—Apply, THE SHEEPBRIDGE COAL & IRON COMPANY, LIMITED, Chesterfield.

WANTED.—FOUNDRY MANAGER; first-class man, able to organise and obtain maximum output per moulder of high-class Grey Iron Castings up to 3 cwt. per casting, Floor, Bench and Machine Moulding; right salary to right man.—State age, salary required, and full qualifications to Box 304, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

WANTED.—Traveller, high-class Castings, Cylinders, etc., on commission.—Write, ROBINSON & NICHOLLS, LIMITED, Loretta Wharf, Strand-on-the-Green, Chiswick, W.4.

WANTED.—Metallurgist for large Industrial Plant; must be conversant with the latest methods of heat treatment tempering and case hardening of steel; applicants should state qualifications, experience, past and present employers, which will be treated confidentially. — Address, "Metallurgist," WM. PORTEOUS & COMPANY, Advertising Agents, Glasgow.

WANTED.—FOUNDRY FOREMAN, experienced in moulding large marine castings and general heavy machine tool castings.—Apply, THE SHEEPBRIDGE COAL & IRON COMPANY, LIMITED, Chesterfield.

FOUNDRY FOREMAN wanted for London district; must have good knowledge of general machine castings, also thoroughly understands mixture of metals; no one unless thoroughly experienced need apply.—Reply, stating wage required, to Box 294, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

SALE BY AUCTION.

SHORT NOTICE OF SALE, WITHOUT RESERVE.

DEPTFORD, S.E. The remaining FOUNDRY and FORGING

PLANT and MACHINERY,

including 3 powerful STRIPPING PRESSES, by Massey, and John Hands, a "Brayshaw" air-blast GAS FURNACE, a "Climax" portable Smith's Hearth with rotary blower and electric motor, "Monometer," "Sturtevant," and other blowers, vice and stand, anvil and stand, swage-block and stand, Smith's tools, 79 new Morgan's "SALAMANDER" CRUCIBLES and bases, 5 PYROMETERS and fittings, power grindstone, two 7 ft. x 3 ft. ¼th plate air-blast cylinders, "Albany" pump, etc., 5 sets of Monometer Furnace Castings, range of 3 incandescent heat ovens, etc., dismantled and including upwards of 50 TONS OF HEAVY WR. AND CAST SCRAP, steel shafting, large split steel and wood pulleys, belting, about 40 TONS of NEW TOOL and DIE STEEL and BILLETS, 10 tons of Steel Press Dies, 32 box and bogie trolleys, office fittings, women's new factory overalls, ambulance stretchers, a nearly new "Criterion" 3-oven gas cooking range, steam boilers, and numerous effects, which will be SOLD by AUCTION by Messrs.

J. T. SKELDING & COMPANY,

upon the premises of Messrs. FORGINGS, LTD., THE STOWAGE, DEPTFORD, S.E., on THURSDAY, DECEMBER 14, 1922, at 12 o'clock precisely.

On view day prior to and morning of sale. Catalogues of the Auctioneers, 48, Gresham Street, Guildhall, E.C.2.

PATENT.

ADVICE and Handbook Free.—KING'S PATENT AGENCY, LIMITED, Director, B. T. King, Reg. Patent Agent, 146a, Queen Victoria Street, E.C.4.

ADVERTISER is prepared to sell his Special Mixture and method of making Chilled Rolls. This process has been used successfully for over 20 years.—Further particulars, apply Box 306, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, Adelphi, Strand, London, W.C.2.

MACHINERY.

NINE nearly new Steel Hopper Wagons, standard gauge, roller bearings.

Two sets of Belt-driven Geared Hydraulic Pumps, 2-in. rams and 4-in. rams.

Brand new 4-ft. under-driven Sand Mill.

10-kw. Steam-driven Lighting Set, 110 volts D.C.; bargains.

HARRY H. GARDAM & COMPANY, LIMITED, STAINES.

Three Lancashire Boilers, 30 ft. x 8 ft., new in 1917, reinsure 100 lbs. working pressure. Two nearly new Steel Lancashire Boilers, 30 ft. x 9 ft., reinsureable at 100 lbs. working steam pressure, complete with steam and furnace fittings, etc., ready for immediate loading, cheap for quick sale. One Lancashire Boiler, 17 ft. x 5 ft. 6 in. diameter, reinsure 80 lbs. pressure. One Lancashire Boiler, 30 ft. x 8 ft. 6 in., suitable for 160 lbs. pressure. One Vertical Cross Tube Boiler, about 13 ft. high x 6 ft. diameter, reinsureable 90 lbs. working pressure. One Hornsby Waste Heatwater Tube Boiler, about 40 h.p., reinsure 160 lbs. pressure. "Galloway" Boiler, 24 ft. x 6 ft. 8 in. diameter, reinsure 100 lbs. pressure. A number of High-pressure Receivers, each about 18 ft. 6 in. long x 4 ft. diameter for 625 lbs. per sq. in. working gas pressure. Several Dishended Cylinders, each 6 ft. x 2 ft., tested hydraulically to 150 lbs. pressure.

Catalogue of Stock Machinery, 6,000 Lots.
Free on Application. Inspection Invited.

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ALBION WORKS,
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COMPANY owning Steel and Non-Ferrous Foundry with Héroult Electric Furnace, well situated in Midlands, is desirous of increasing its capital with view to purchasing Works at present held on lease. The position of Secretary and two vacancies on Board of Directors are to be filled.—Inspection invited, and interested parties are asked to write for details to Box 300, Offices of the FOUNDRY TRADE JOURNAL, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

MISCELLANEOUS.

A GOOD CORE OIL.

Here is a product which is the result of careful research work and practical experience

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Do you know Corbeerite? If not, try a cask! You will then understand why so many successful foundries use it in preference to all other gums and oils. It is an asset to every foundry. **CORBEERITE also saves Sand. You can use Old Sand with it.** **CORBEERITE** can be diluted (1 part with 30 parts of water), or can be used as a stronger solution if necessary. It is used in the same way as other oils for binding purposes. **28/6** per cwt., in 4 to 5 cwt. casks, delivered, casks free. One trial drum of this oil, containing about 130 lbs., sent to each foundry at the same price. Carriage paid. This offer is solely for trial purposes, and only one cask can be sent to each foundry.

ALSO SUPPLIED IN POWDER FORM.

CORBEERITE POWDER is used with core sand for intricate work, and is particularly useful for preventing blown castings. Half a pound to a riddle-full of core sand mixed with dried horse-manure, is a real aid to clean, satisfactory work. Used also in crushed cores, and can be used in conjunction with Corbeerite Oil as a binder, but the powder is not a binder in itself. **60/-** per cwt., in 56-lb. bags, delivered. Bags free.

Write for full particulars, or send a Trial Order, TO-DAY.

Beecroft & Partners, Ltd., Metallurgical & Foundry Experts, **ST. PETER'S CLOSE, SHEFFIELD.**

SAND MILLS

One 6-foot, by J. W. Jackman, as new, lying at Manchester, **£50 F.O.R. Bradford.**

Two 4-foot sand mills, in my London Stock, good as new, underdriven, £28 each.

One 4-foot sand mill, by Phillips, overdriven, lying at Stoke-on-Trent, £28.

Pneumatic sand sifter, equal to new, £12.

Belt-driven sand sifter, in good order, £8.

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No. 1. Green Cupolette, excellent condition, £25.

30" Alldays Cupola, drop bottom, as new, £50.

48" Thwaites Cupola, latest type, £110.

Above are *Selections* from Stock. I carry every kind of foundry machinery, new and secondhand. Send me your enquiries.

ALEX HAMMOND, *Foundry Machinery Merchant,*
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